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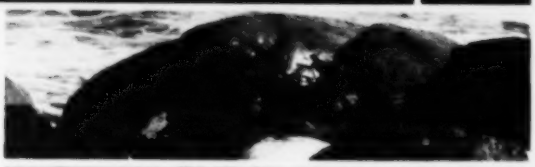
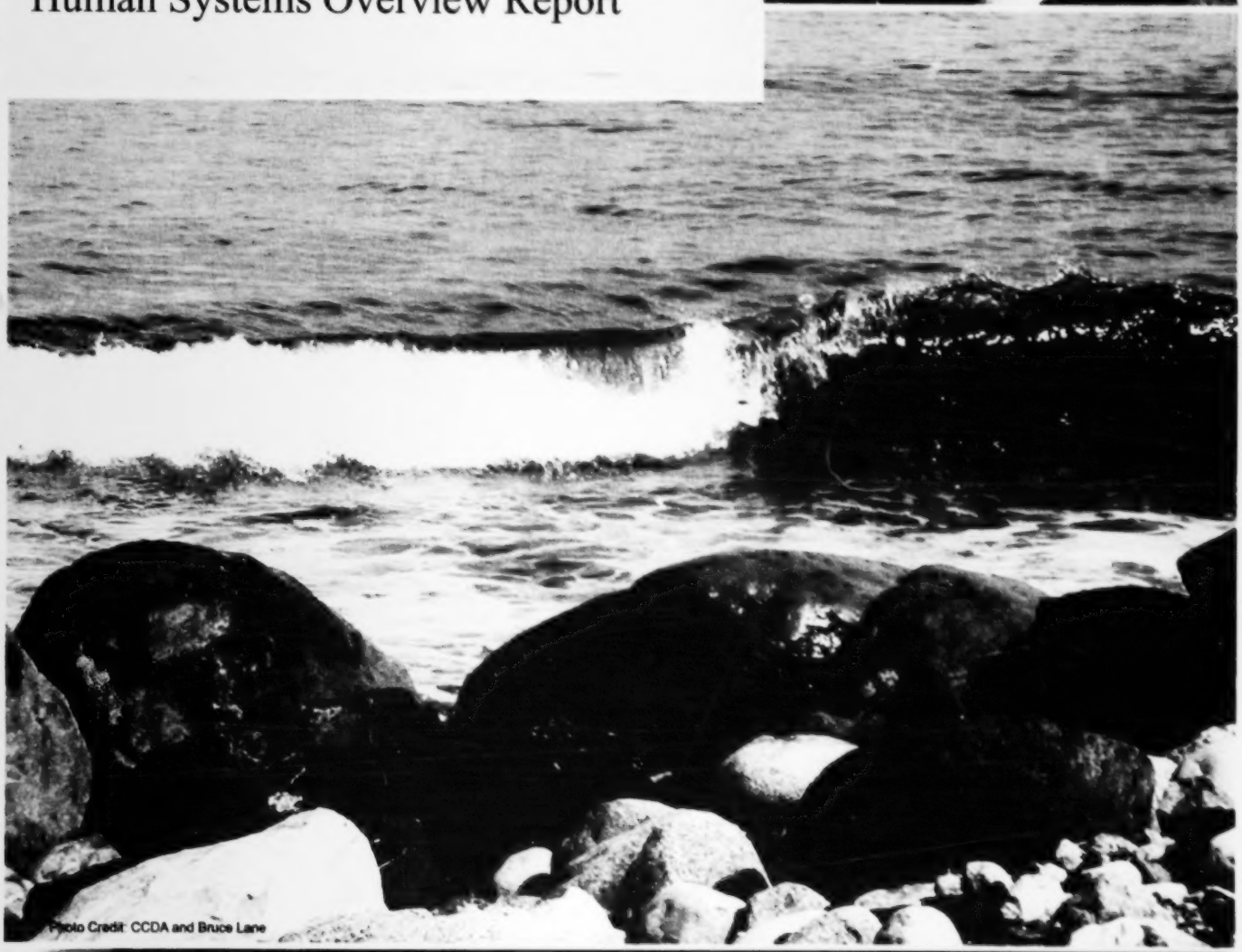
Gulf of St. Lawrence: Human Systems Overview Report





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GULF OF ST. LAWRENCE: HUMAN SYSTEMS OVERVIEW REPORT

by

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EXECUTIVE SUMMARY

GULF OF ST. LAWRENCE: HUMAN SYSTEMS OVERVIEW

Assessing and managing human impacts on the biological and physical components of the Gulf of St. Lawrence and understanding the impact (social, cultural and economic) these components have on coastal communities requires a clear understanding of the human systems. These include the governance structures, human settlement patterns and human activities occurring within both coastal and marine environments.

Governance Structures

The Gulf of St. Lawrence is a complex multi-jurisdictional setting made up of the Government of Canada, five provincial governments (Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island and Quebec), and numerous municipal governments. Federal oceans responsibilities within the Gulf of St. Lawrence include regional delegations in Fisheries and Oceans Canada (Newfoundland and Labrador, Gulf and Quebec Regions) and Environment Canada (Atlantic and Quebec Regions) as well as a number of other federal agencies. First Nations and other Aboriginal groups (21 Mi'kmaq groups, 7 Montagnais (Innu), 1 Malecite and 1 Métis) share a common interest in the management of coastal and marine activities and resources. The Constitution Act (1982) and the Oceans Act (1997) respect historical treaties and traditional rights of First Nations and other Aboriginal groups, recognizing their traditional ecological knowledge as an important component in understanding marine ecosystems. Thirty federal acts and more than 100 provincial acts provide for regulation of ocean related activities and issues throughout the Gulf of St. Lawrence. These regulations are not necessarily coordinated among federal agencies or the five coastal provinces. At the municipal level, bylaws and zoning regulations govern coastal activities of more than 400 communities bordering the Gulf of St. Lawrence. Municipal governments have the potential to contribute substantially to management of coastal and marine areas through responsible coastal and infrastructure planning. Non-government agencies such as industry associations, environmental and stewardship groups, economic development boards as well as individual ocean users also contribute to sustainability of oceans resources in the Gulf of St. Lawrence through corporate and ethical use policies.

Human Settlements

Accessibility to a highly productive marine environment and markets in both inland North America and in Europe have for centuries influenced human settlement and socio-economic development around the Gulf of St. Lawrence. Based on the 2001 census, the total population in the Gulf of St. Lawrence was approximately 860,000, a decrease of about 4% from the 1996 census, perhaps reflective of some movement out of the area in recent years. Average population density in 2001 was three times the Canadian average, at 9.9 inhabitants per sq km, with 17% of the population under age 15 and 19% over age 60, similar to the national average. Aboriginal populations showed a slightly different trend with a 30-40% of the population below age 15 and less than 8% over age 60. Approximately 43% of the population spoke only English, 51% only French (mainly Quebec), 5% both English and French (NB and Quebec) and 1% another non-official language. Montagnais (Innu) generally speak their own language, often in combination with French or English. In 2001, traditionally seasonal, resource-based industries (fisheries, agriculture, forestry and mining) employed 11% of the active workforce, almost twice the national average. Annual incomes averaged $23,000 with 47% of the population earning less than $15,000, both about 22% less than the national average. Meanwhile, 19% of the population had less than a grade nine education, and only 10% had obtained a university degree, compared to the national averages of 11% and of 17% respectively. This may be reflective of lower access to higher education in rural areas, but there may be other factors as well.

Human/Industrial Activities

Activities such as commercial fishing, aquaculture, oil and gas exploration, marine transportation, coastal and marine tourism and recreation, dredging and a number of land-based industries provide

social, cultural and economic benefits to people living along the Gulf of St. Lawrence. Industrial and economic development can place pressure on the biological and physical components of this marine ecosystem and potentially create conflicts among users of ocean space.

Commercial fisheries, including groundfish, pelagic and shellfish fisheries, and marine plant and seal harvesting target more than 50 species within the Gulf of St. Lawrence. Moratoria placed on Atlantic salmon, Atlantic cod and redfish stocks during the early 1990's resulted in increased fishing effort on a number of previously underutilized, but potentially more valuable species including snow crab, shrimp and lobster. Recent statistics (1997-2001) show that average landings decreased by 32% (to 223,069t) compared to 1990-1991 (immediately prior to any moratorium on commercial fishing), while average value increased by 37% (to $467 million) over the same period. On average, from 1992 to 2001, harp seal landings within the Gulf of St. Lawrence represented 30% (approximately 4,900-143,000 seals) of the total Northwest Atlantic seal landings. Traditionally, commercial fishing has probably influenced coastal settlement more than any other industry and continues to provide social, cultural and economic benefits to coastal communities. Meanwhile, commercial fishing activity has the potential to adversely impact fish stocks and marine habitat. There has been much controversy over the effects of past fishing and management practices on marine fish stocks and marine habitat.

Marine aquaculture continues to emerge as an important economic generator throughout many parts of the Gulf of St. Lawrence, especially since the downturn in a number of commercial fisheries. Approximately 1800 aquaculture sites exist throughout the Gulf of St. Lawrence, with 96% concentrated along Prince Edward Island, Nova Scotia and New Brunswick. Oyster and blue mussel production account for 99% of commercial aquaculture sites, experiencing a 17% production growth from 2000 to 2001 (33,900t). Ocean user conflicts, escapement of foreign and potentially invasive species, and spread of disease to wild fish stocks are areas of concern for this industry.

Oil and gas activity within the Gulf of St. Lawrence is mainly exploratory with 60,000 km of offshore seismic data acquired since the 1960's and offshore drilling limited to less than a dozen wells (none have reached production). Meanwhile, more recent onshore drilling has produced minor discoveries on the Port aux Port Peninsula (Newfoundland and Labrador), Gaspé Peninsula (Quebec) and in southern New Brunswick where exploitation per production licenses currently exist. Active exploratory licenses/permits exist within the offshore area of Newfoundland and Labrador, Nova Scotia and Quebec, and coastal onshore areas of all five provinces. Offshore seismic operations have the potential to conflict with commercial fishing and other marine activities. Meanwhile, little is known regarding the effect of seismic activities on the behaviour of marine organisms. Accumulation of drilling debris and accidental spills are potential concerns as the industry develops.

The Gulf of St. Lawrence accommodates approximately 6,400 commercial vessel transits annually through the Cabot Strait (Strait of Belle Isle provides an alternate route during ice-free seasons), supporting domestic and international trade through the shipment of petroleum, mining, forestry, fishery and agricultural products and cruise ship activity. While much of this traffic continues on to the Great Lakes, more than 40 ports throughout the Gulf of St. Lawrence accommodate vessel traffic. Contamination of marine areas from bilge, ballast and wastewater disposal, marine safety and transport of foreign and invasive species are potential concerns within the marine transportation industry.

Coastal and marine tourism and recreation is an industry experiencing growth throughout the Gulf of St. Lawrence, evidenced by increased cruise ship activity, offshore excursions (whale watching and marine tours), recreational boating as well as golf course and cottage development. Modern cruise ships accommodating more than 4,000 people per voyage (larger than the population of most coastal municipalities along the Gulf of St. Lawrence) are estimated to produce 400,000 gallons of wastewater per day. Similar to other large ocean vessels, cruise ships have the potential to transport non-native species and contaminate marine areas through bilge, ballast and wastewater disposal. A

number of conservation and protected areas exist throughout the Gulf of St. Lawrence including national parks (7) and historic sites (7), provincial parks (59), migratory bird sanctuaries (20), national wildlife areas (13) and ecological reserves (8). Many of these areas are becoming the focal point of a growing tourism industry.

Dredging occurs within many ports and harbours throughout the Gulf of St. Lawrence to ensure the safe movement of marine vessel traffic. Annual re-dredging is required at many locations due to natural processes of erosion and sedimentation that constantly fill in marine basins. Although less common, marine disposal of dredging material does occur throughout the Gulf of St. Lawrence. Loss of habitat and localized species are concerns associated with dredging and marine disposal of dredging material.

Land-based activities, particularly those that take place along the coastline, have the potential to impact the Gulf of St. Lawrence. Approximately 20 pulp and paper mills, 13 mineral processing operations (including six aluminium processing plants along the Quebec Lower North Shore), and more than 200 fish processing plants exist along the Gulf of St. Lawrence. More than 1,000 dams (large and small) exist on waterways that flow into the Gulf of St. Lawrence. Approximately 1.5 million hectares of agricultural land border the Gulf of St. Lawrence with Prince Edward Island (522,964 ha), the North Shore of Nova Scotia (198,008 ha) and the Bas-Saint-Laurent area (350,251 ha) of Quebec accounting for over two thirds of total acreage. Meanwhile, many municipalities still release untreated sewage into the Gulf of St. Lawrence. Land-based activities have the potential to impact marine areas through the release of biological and chemical contaminants from industrial processing, food processing and agricultural operations, and through municipal sewage and storm sewer systems. Alteration of waterways flowing into the Gulf of St. Lawrence also has an impact on migrating diadromous fish species and estuarine environments.

Synopsis

The biological and physical components of the Gulf of St. Lawrence support numerous coastal and marine activities that influence human settlement and contribute to the social, cultural and economic well-being of coastal communities. At the same time, human activities place pressure on the health and sustainability of the Gulf of St. Lawrence ecosystem. The impact and economic importance of individual activities at the local, provincial, regional or national scales may vary and, at least in part, reflects the reason that management and regulation of oceans activities in the Gulf takes place at many jurisdictional levels. Achieving a balance between the need for input into oceans management at all levels and economic and ecosystem sustainability will be particularly challenging in the Gulf of St. Lawrence.

Canada's Oceans Strategy commits to taking an integrated approach to oceans management; providing stakeholders with the opportunity to input on decisions that affect them, supported by good science and traditional ecological knowledge. Sustainable use of ocean resources in the Gulf of St. Lawrence requires an understanding of the structure and function of the Gulf of St. Lawrence ecosystem combined with an understanding of the interaction of the wide range of human systems and activities. This report, in conjunction with other biophysical and socio-economic information, provides a basis to support an integrated management planning process for the Gulf of St. Lawrence and its estuary.

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ABSTRACT

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Provided is a descriptive overview of the human systems in the Gulf of St. Lawrence and estuary including the governance structures, human settlement patterns, and human and industrial activities. The Gulf of St. Lawrence Large Ocean Management Area is a complex multi-jurisdictional setting, comprised of five provincial governments, numerous federal jurisdictions as well as municipalities, Aboriginal groups and non-governmental organizations. Human settlement is distributed throughout the entire coastal area surrounding the Gulf of St. Lawrence and is diverse in terms of language, culture and economy. Numerous, diverse human and industrial activities contribute to the social, cultural and economic stability of more than 400 coastal municipalities and have the potential to exert pressure on this marine ecosystem, with many interests competing for resources and ocean space.

Challenges experienced with bringing together information at the scale of the Gulf of St. Lawrence may symbolize both the challenges and the opportunities that may exist in developing and implementing a more integrated approach to managing ocean resources and activities. In conjunction with other biophysical and socio-economic information, this report provides a basis for an integrated management planning process in the Gulf of St. Lawrence and estuary. As human systems change over time due to changing social, cultural and economic conditions, this overview will need to be continually revised.

RÉSUMÉ

Alexander, D.W., Sooley, D.R., Mullins, C.C., Chiasson, M.I., Cabana, A.M., Klvana, I., and J.A. Brennan 2010. Gulf of St. Lawrence: Human Systems Overview Report. Oceans, Habitat and Species at Risk Publication Series, Newfoundland and Labrador Region. 0002: xiv + 154 p.

Les pages qui suivent contiennent un aperçu descriptif des systèmes mis en place par les humains dans le golfe et dans l'estuaire du Saint-Laurent, y compris des structures de gouvernance, des habitudes en matière d'établissements humains ainsi que des activités humaines et industrielles. La zone étendue de gestion de l'océan que représente le golfe du Saint-Laurent est une zone complexe relevant d'instances multiples, dont cinq gouvernements provinciaux et de nombreuses autorités fédérales, auxquels s'ajoutent des municipalités, des groupes autochtones et des organisations non gouvernementales. Les établissements humains sont répartis dans toute la région côtière bordant le golfe du Saint-Laurent et varient dans leur langue, leur culture et leur économie. Des activités humaines et industrielles nombreuses et diverses contribuent à la stabilité sociale, culturelle et économique de plus de 400 municipalités côtières, mais risquent d'exercer une pression sur cet écosystème marin, de nombreux secteurs d'activité se disputant les ressources et l'espace océanique.

Les difficultés rencontrées dans l'obtention d'information à l'échelle de tout le golfe du Saint-Laurent sont peut-être le reflet des défis mais aussi des possibilités que peuvent engendrer l'élaboration et la mise en œuvre d'une démarche plus intégrée dans la gestion des ressources de l'océan et des activités dont celui-ci est le siège. Associé à d'autres renseignements biophysiques et socioéconomiques, le présent rapport offre la base d'un processus de planification d'une gestion intégrée dans le golfe et dans l'estuaire du Saint-Laurent. Il devra toutefois être continuellement actualisé en fonction des changements que l'évolution des conditions sociales, culturelles et économiques occasionne dans les systèmes humains.

1.0 INTRODUCTION AND METHODOLOGY

Human systems are an important part of the Gulf of St. Lawrence ecosystem (Figure. 1-1). How we govern ourselves, how we have settled coastal areas and what activities we undertake in coastal and marine areas can and does have profound effects on biological and physical components of the ecosystem. An understanding of the human element including governance, human settlements and human/industrial activities in the Gulf of St. Lawrence (including the St. Lawrence estuary) is necessary to guide the development of an integrated management planning process and to minimize potential ecosystem impacts.

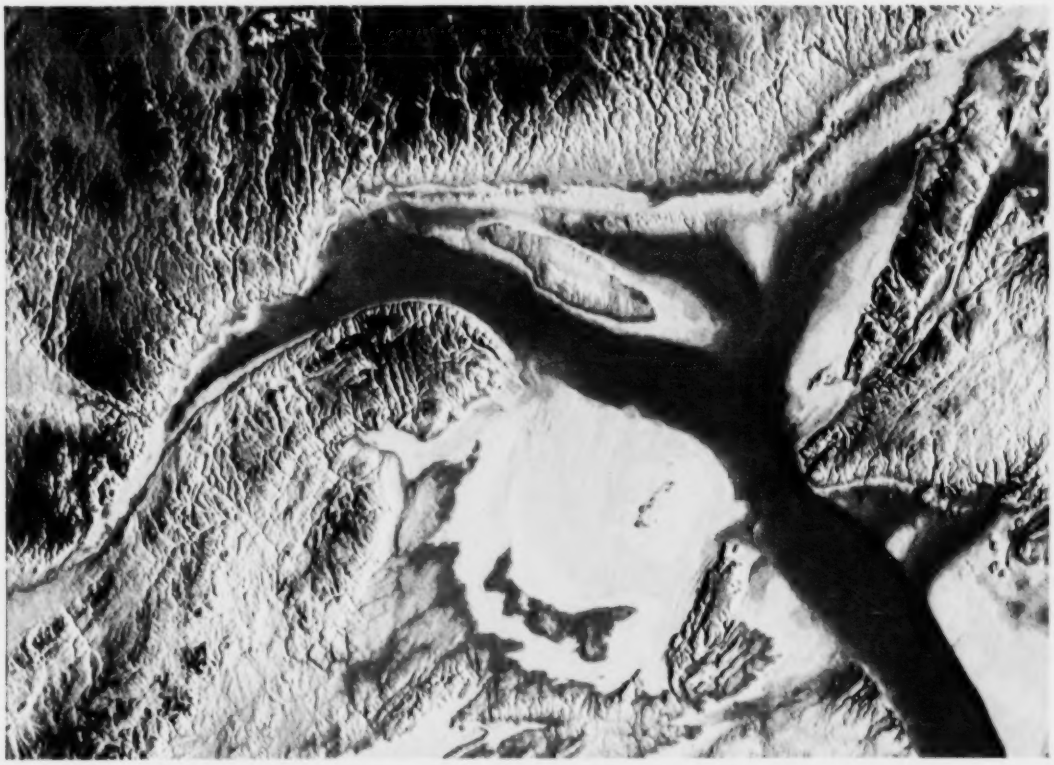

Figure 1-1 Gulf of St. Lawrence. (Courtesy of Fisheries and Oceans Canada).

The purpose of this report is to provide a general description of the human systems within the Gulf of St. Lawrence ecosystem area. It is not meant to be a definition of current status or an assessment of ecological or economic impacts associated with human activities.

Human systems are described based on available information including scientific literature, government publications and the world-wide-web. In some cases, information on activities was compiled from databases residing in different provincial and federal jurisdictions where formatting was often inconsistent. Therefore, pooling to the lowest common variables was sometimes necessary. In many cases, information related specifically to the Gulf of St. Lawrence as a whole was either unavailable or impossible to separate out from other parts of the province or jurisdiction. As a result, it was sometimes difficult to take a Gulf-wide approach. Hence, some activities were described on a provincial basis.

Human systems are described in three separate sections:

1. **Governance Structures** – provides an overview of how we govern what happens within coastal and marine areas within the Gulf of St. Lawrence, how we are governed federally and provincially, and how Aboriginal groups, non-governmental organizations and the general public factor into coastal and marine governance. This includes an overview of federal and provincial government departments, their respective legislative responsibilities in relation to ocean management and use, as well as an overview of federal and provincial electoral ridings adjacent to the Gulf and a general overview of key Aboriginal groups and communities adjacent to the Gulf of St. Lawrence.

2. **Human Settlement** - provides a brief and general overview of recent patterns of human settlement and population change and foremost economic drivers within the Gulf of St. Lawrence. Statistics Canada census data for the 12 economic zones bordering the Gulf of St. Lawrence was used as the primary source of information.

3. **Human/Industrial Activities** – provides general information on the location, distribution, and nature of the major human and/or industrial activities within the coastal and marine areas of the Gulf of St. Lawrence including: commercial fishing; oil and gas exploration; marine transportation and shipping; aquaculture; tourism and recreation, and land-based activities (e.g. pulp and paper, mining and mineral processing, municipal sewage, fish processing, and agriculture)..

2.0 GOVERNANCE STRUCTURES

2.1 INTRODUCTION

The Gulf of St. Lawrence is a complex multi-jurisdictional setting consisting of the Government of Canada, five provincial governments (Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island and Quebec), and numerous municipal governments. First Nations and other Aboriginal groups, non-governmental organizations (economic development boards and associations), environmental and stewardship groups, industry and individual ocean users also share an interest in the management of coastal and marine activities and resources. A multitude of federal and provincial legislative acts and municipal by-laws govern human activities within coastal, marine and estuarine areas throughout the Gulf of St. Lawrence.

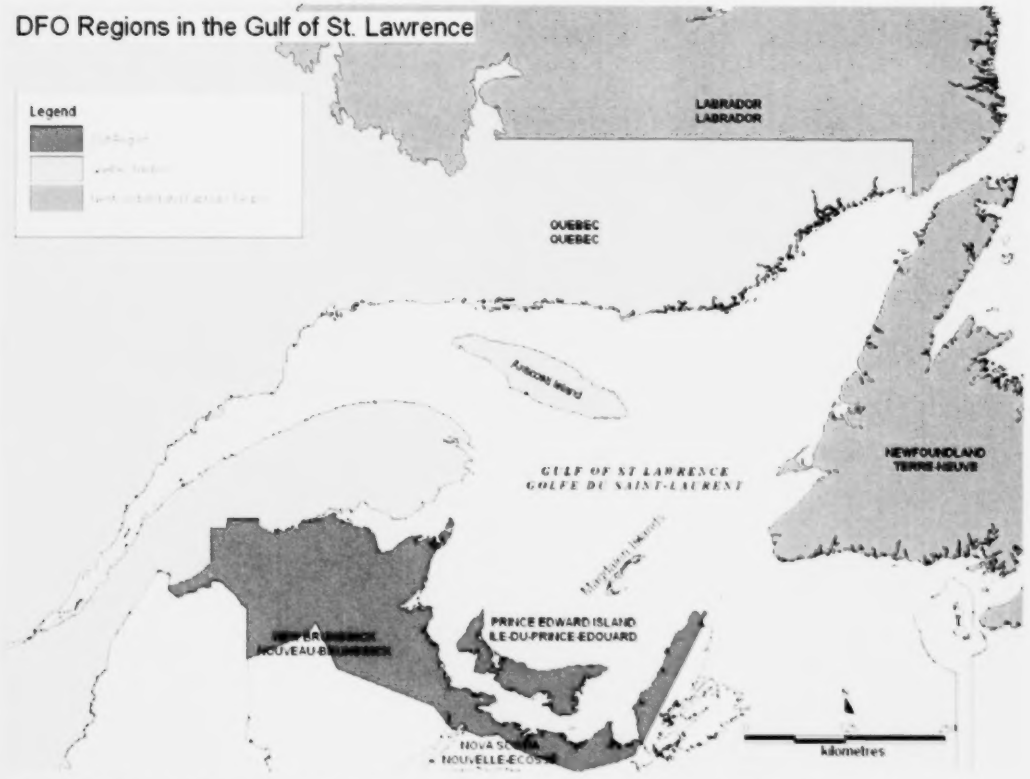

Figure 2-1 Five provinces and three Fisheries and Oceans Canada regions border the Gulf of St. Lawrence.

2.2 GOVERNMENT DEPARTMENTS AND AGENCIES

Federal (DFO 1997*a*) and provincial (DFO 1997*b*) governments play a crucial role in the conservation and protection of Canadian marine, coastal and estuarine waters and in the management of proposed and ongoing activities within in these waters. Many marine-based activities are managed at the federal level with provincial governments taking the lead on most land-based activities. Meanwhile, a number of these activities, both marine and land-based, operate under legislation from both levels of government. Joint federal/provincial bodies exist throughout the Gulf of St. Lawrence, representing the shared interests of both levels of government.

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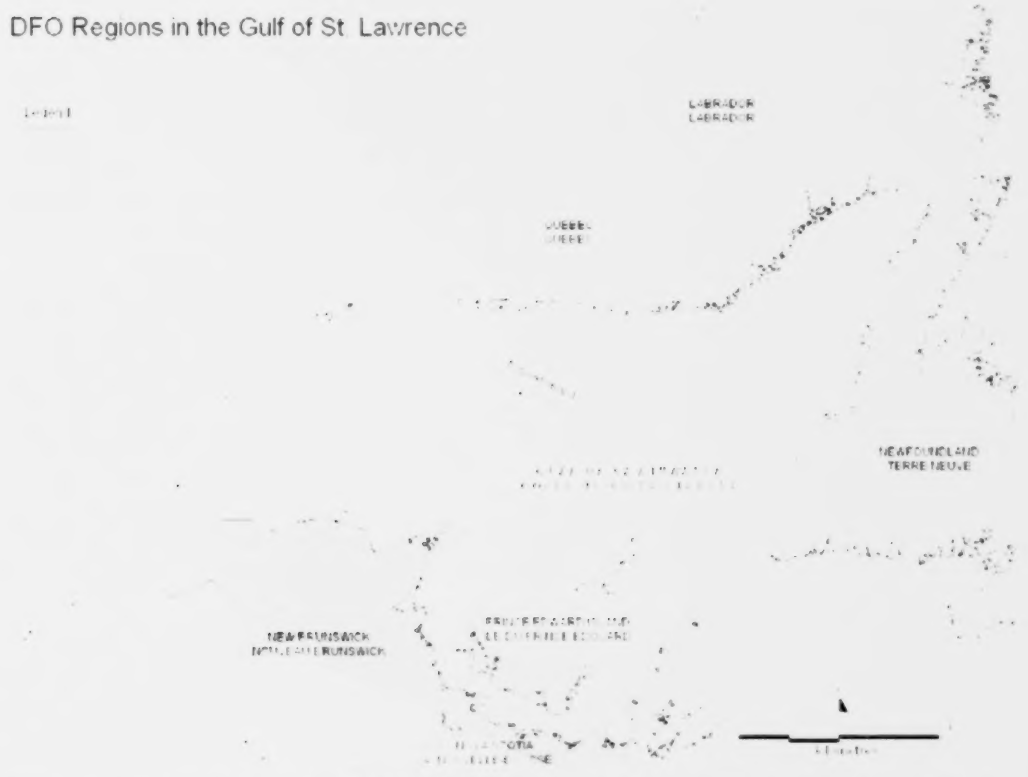

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2.2.1 Federal Government Departments

Twelve federal departments (Table 2-1) and numerous federal agencies have some degree of involvement in the management of marine activities through more than 30 federal legislative acts. Many federal departments delegate ocean related responsibilities within the Gulf of St. Lawrence to regional levels within their respective departments including Fisheries and Oceans Canada (Newfoundland and Labrador, Gulf and Quebec Regions), (Figure 2-1) and Environment Canada (Atlantic and Quebec Regions). Appendix I provides a list of federal legislation and associated marine related responsibilities within the Gulf of St. Lawrence.

Table 2-1 Federal departments with legislative responsibility for ocean activities in the Gulf of St. Lawrence.

Federal Department	Legislation
Fisheries and Oceans Canada	Fisheries Act; Oceans Act; Canada Shipping Act; Coastal Fisheries Protection Act; Fishing and Recreational Harbours Act
Foreign Affairs Canada	Coastal Trade Act; Foreign Affairs and International Trade Act; Oceans Act
National Defence	Canada Shipping Act; International Convention for Safety of Life at Sea Act; Emergency Preparedness Act; National Defence Act
Justice Canada	Department of Justice Act
Indian and Northern Affairs	Canada Petroleum Resources Act
Industry Canada	National Research Council Act; Government Organisation Act Atlantic Canada 1987; Natural Sciences and Engineering Research Act
Natural Resources Canada	Canada-Newfoundland Atlantic Accord Implementation Act; Canada-Nova Scotia Offshore Resources Implementation Act; Canada Oil and Gas Operations Act; Canada Petroleum Resources Act
Transport Canada	Canada Shipping Act; Coastal Trade Act; International Convention for Safety of Life at Sea Act; Emergency Act; National Transportation Act; Pilotage Act; Public Harbours and Port Facilities Act; St. Lawrence Seaway Authortiy Act; Navigable Waters Protection Act
Privy Council	Canadian Transportation Accident Investigation and Safety Board Act
Parks Canada	National Parks Act
Health Canada	Food and Drug Act
Environment Canada	Canadian Environmental Assessment Act (CEAA); Canada Wildlife Act; Canadian Environmental Protection Act (CEPA); Fisheries Act (S.36-42); Migratory Birds Convention Act, 1994

2.2.2 Provincial Government Departments

Five provincial governments (Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island and Quebec) have jurisdiction over land-based activities within their respective provinces bordering the Gulf of St. Lawrence (Figure 2-1), many of which interact directly and indirectly with the marine environment. In the past, the Government of Canada has delegated a number of marine related responsibilities to provincial governments including aquaculture licensing responsibilities within the respective provinces of Newfoundland and Labrador, Nova Scotia, New Brunswick, and Quebec; and management of diadromous fish species within Quebec to the Quebec government. Fisheries and Oceans Canada (DFO 1997*b*) provides an overview of the role of provincial and territorial governments within the oceans sector. There are 28 departments and more than 100 provincial legislative acts (Table2-2) directly or indirectly governing activities associated

with this marine environment. Meanwhile, provincial legislation is not necessarily coordinated among the five provinces. Appendix II lists provincial government departments and legislation which have relevant marine related responsibilities within the Gulf of St. Lawrence.

Table 2-2 Number of provincial departments and legislative acts with marine related responsibilities in the Gulf of St. Lawrence.

Province	Number of Departments	Number of Acts
Newfoundland and Labrador	6	13
Quebec	6	68
New Brunswick	7	17
Nova Scotia	7	17
Prince Edward Island	2	3
Total	28	118

2.2.3 Joint Federal/Provincial Management

A number of marine activities throughout the Gulf of St. Lawrence are managed at a joint federal/provincial level. The Canada-Newfoundland and Labrador Offshore Petroleum Board (CNLOPB) and Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) manage oil and gas activities within the offshore regions of Newfoundland and Labrador and Nova Scotia respectively, representing the shared interests of both levels of government. Similar agreements between the Government of Canada and the other three provinces (New Brunswick, Prince Edward Island and Quebec) are still under discussion. In the past, the Government of Canada delegated licensing responsibilities for aquaculture operations to the provincial governments, but still play a major role in the development of this industry. The Plan d'Action Saint-Laurent is a joint federal, provincial (Quebec) and non-governmental program that pursues the mission of cleaning up the St. Lawrence estuary. There are probably many more activities throughout the Gulf of St. Lawrence that operate under legislation from multiple levels of government.

2.2.4 Municipal Governments

Numerous municipal governments exist along the Gulf of St. Lawrence, representing a coastal population of more than 800,000 (Statistics Canada 2001*a*). Many municipal governments enforce by-laws to manage activities occurring within municipal boundaries; activities that have the potential to interact with the marine environment including sewage disposal and development of coastal areas (i.e. residential, golf course, and agricultural development). At the municipal level, coordination of bylaws governing coastal activities may be unrealistic due to the large number of municipalities (approximately 400) bordering the Gulf of St. Lawrence. Municipal governments have the potential to contribute to the sustainability of coastal and marine areas through responsible coastal and infrastructure planning.

2.3 FEDERAL AND PROVINCIAL LEGISLATIVE REPRESENTATION

Federal legislative ridings (electoral districts) each have an elected member that represents residents of that riding at the federal level of government. Similarly, all provinces are divided into provincial legislative ridings (electoral divisions); each having an elected member to represent residents of the respective ridings at the provincial level of government. Geographically, federal and provincial legislative ridings overlap; with each federal legislative riding consisting of more than one provincial legislative riding.

2.3.1 Federal Legislative Ridings

The provinces of Newfoundland and Labrador, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island are represented in the Canadian legislature by representatives from 107 electoral ridings (Elections Canada 2004). There are 21 ridings located, in whole or in part, adjacent to the Gulf

of St. Lawrence: Newfoundland and Labrador (3), Quebec (6), New Brunswick (4), Nova Scotia (4) and Prince Edward Island (4); (Table 2-3).

Table 2-3 Federal legislative electoral districts bordering the Gulf of St. Lawrence.

Province	Federal Legislative Electoral District
Newfoundland and Labrador	Labrador; Random-Burin-St. George's; Humber-St. Barbe-Baie Verte
Quebec	Gaspésie - Îles-de-la-Madeleine ; Haute-Gaspésie - La Mitis – Matapédia - Matane ; Rimouski-Neigette – Témiscouata - Les Basques ; Montmagny - L'Islet – Kamouraska - Rivière-du-Loup ; Montmorency – Charlevoix - Haute Côte-Nord ; Manicouagan
New Brunswick	Madawaska-Restigouche; Acadie-Bathurst; Miramichi; Beausejour-Petitcodiac
Nova Scotia	Cumberland-Colchester; Pictou-Antigonish-Guysborough; Bras d'Or- Cape Breton; Sydney-Victoria
Prince Edward Island	Egmont; Malpeque; Hillsborough; Cardigan

2.3.2 Provincial Legislative Ridings

There are 75 provincial legislative ridings (electoral divisions) within five provinces bordering the Gulf of St. Lawrence (Table 2-4): Newfoundland and Labrador (9), (Elections Newfoundland and Labrador 2004); Quebec (12), (Le Directeur Général des Élections du Québec 2004); New Brunswick (17), (Office of the Chief Electoral Officer 2004); Nova Scotia (8); and Prince Edward Island (29), (Elections Prince Edward Island 2004).

Table 2-4 Provincial legislative electoral divisions bordering the Gulf of St. Lawrence.

Province	Electoral Division
Newfoundland and Labrador	Cartwright-Lanse au Clair; The Straits and White Bay North; St. Barbe; Humber Valley; Humber East; Humber West; Bay of Islands; Port au Port; St. George's – Stephenville East
Quebec	Îles-de-la-Madeleine; Gaspé; Bonaventure; Matane; Matapédia; Rimouski; Rivière-du-Loup; Kamouraska-Témiscouata; Montmagny - L'Islet; Charlevoix; René-Lévesque; Duplessis
New Brunswick	Restigouche West; Campbellton; Dalhousie-Restigouhe East; Nigadoo-Chaleur; Bathurst; Nepisiguit; Caraquet; Lameque-Shippigan-Miscou; Centre-Peninsule; Tracadie-Shiela; Miramichi Bay; Miramichi-Bay du Vin; Rogersville-Kochibouguac; Kent; Kent South; Shediac-Cap Pele; Tantramar
Nova Scotia	Cumberland North; Cumberland South; Colchester North; Pictou West; Pictou Centre; Pictou East; Antigonish; Inverness
Prince Edward Island	Winsloe-West Royalty; Parkdale-Belevedere; Charlottetown-Kings Square; Charlottetown-Spring Park; Charlottetown-Rochford Park; Stanhope-East Royalty; Glen Stewart-Bellevue Cove; Sherwood-Hillsborough; Wilmot-Summerside; St.Eleanors – Summerside; Cascumpec-Grand River; Evangeline-Miscouche; West Point-Bloomfield; Alberton-Miminegash; Tignish-Deblois; Borden-Kinkora; Kensington-Malpeque; Park Corner-Oyster Bed; Crapaud-Hazel Cove; North River- Rice Point; Winsloe-West Royalty; Stanhope-East Royalty; Souris-Elmira; Morell-Fortune Bay; Georgetown-Baldwin's Road; Montague-Kilmuir; Murray River-Gasperaux; Belfast-Pownal Bay; Tracadie-Fort August

2.4 TRADITIONAL/ABORIGINAL GOVERNANCE

The coastal areas of the Gulf of St. Lawrence have historically been occupied by a number of Aboriginal groups, the most recent are the Mi'kmaq, Montagnais (Innu), Malecite and Métis, consisting of 30 Aboriginal bands including 21 First Nations (Figure 2-2); (Appendix III). First Nations and other Aboriginal groups have a shared interest in the management of coastal and marine activities and resources within the Gulf of St. Lawrence. The Constitution Act (1982) and the Oceans Act (1997) respects the historical treaties and traditional rights of Aboriginal people. Aboriginal people have much to contribute to the management of coastal and marine activities and resources through their traditional ecological knowledge; knowledge that is an important component of understanding this complex marine environment.

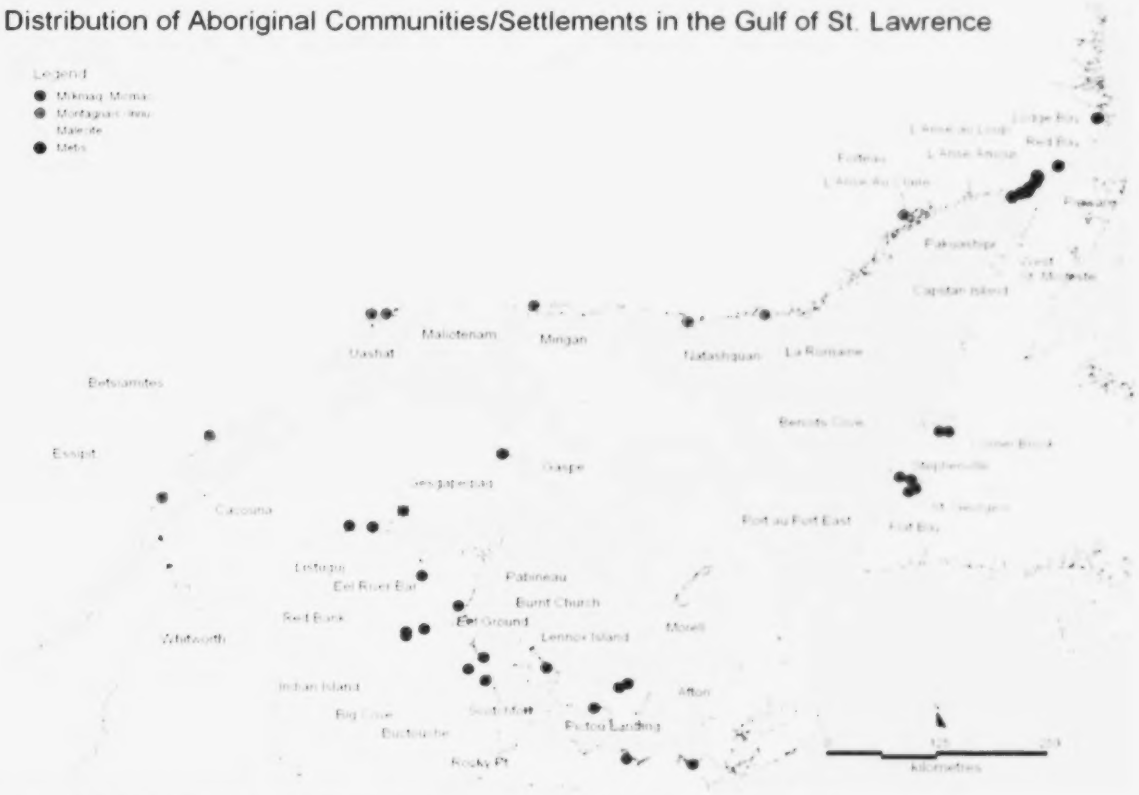

Figure 2-2 Aboriginal communities and settlements along the Gulf of St. Lawrence.

2.4.1 Mi'kmaq

Mi'kmaq people reside within all five provinces along the Gulf of St. Lawrence represented by 21 band councils (14 First Nations); (Figure 2-2; Table 2-5). The Federation of Newfoundland Indians (member of the Congress of Aboriginal Peoples of Canada) represents six band councils and people of Mi'kmaq ancestry throughout a number of communities along western Newfoundland and Labrador (Federation of Newfoundland Indians 2004). The Mi'kmaq nation of Quebec has an approximate population of 4,800 divided among three distinct communities (Listuguj, Gesgapegiac and Gespeg) along the southern shore of the Gaspé Peninsula (Indian and Northern Affairs Canada 2003). Mi'kmaq presence along eastern New Brunswick is represented by eight bands: Buctouche First Nation; Pabineau Mi'kmaq Nation; Burnt Church First Nation; Red Bank/Metepenagiag Mi'kmaq Nation; Eel Ground First Nation; Indian Island First Nation; Elsipogtog (Big Cove) First Nation; Eel River Bar

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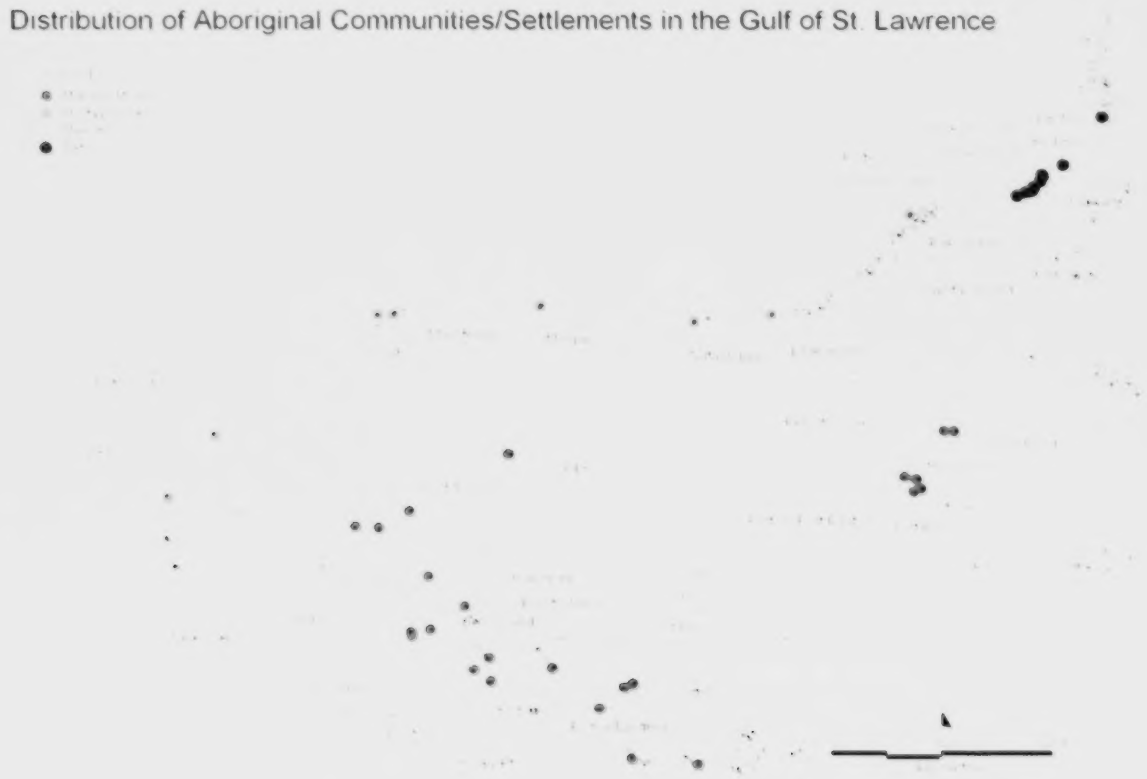

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Mi'kmaq Nation (New Brunswick Aboriginal Affairs Secretariat 2004). In Nova Scotia, Mi'kmaq is currently spread throughout Nova Scotia in 13 Mi'kmaq bands or first nations organized into two tribal councils – Confederacy of Mainland Mi'kmaq and Union of Nova Scotia Indians (Indian and Northern Affairs Canada 2004). The Pictou Landing First Nation and Paq'tnkek (Afton) First Nation bands are located along the Gulf of St. Lawrence. Two Mi'kmaq bands exist in Prince Edward Island, the Abegweit and Lennox Island First Nation (Indian and Northern Affairs Canada 2004).

Table 2-5 Mi'kmaq bands and communities/reserves along the Gulf of St. Lawrence.

Province	Aboriginal Bands	Aboriginal Communities/ Reserves
Newfoundland and Labrador	6	N/A
Quebec	3	3
New Brunswick	8	17
Nova Scotia	2	7
Prince Edward Island	2	4
Total	21	N/A

2.4.2 Montagnais (Innu)

Along the Gulf of St. Lawrence, the Montagnais (Innu) only occupy areas along the North and Lower North shores of Quebec (Figure 2-2). Montagnais people in nine communities are represented by seven band councils: Pakuashipi; La Romaine (Unamen Shipu); Natashquan; Mingan (Ekuanishit); Uashat mak Mani-Utenam; Betsiamites; and the Essipit (Gouvernement du Québec 2004*a*). This population is part of a larger Montagnais First Nations which is the largest First Nations group in Quebec representing approximately 15,170 people (Indian and Northern Affairs Canada 2004).

2.4.3 Malecite (Maliseet) Nation

Along the Gulf of St. Lawrnence, the Malecite (Maliseet) Nation is located within the Bas-St-Laurent region of Quebec. In 1989, the government of Quebec recognized the Viger Malecites as the 11th Aboriginal nation of the province. Faithful to their semi-nomadic lifestyle, the Viger Malecites refuse to be confined to a reserve and none of them live permanently on either of their federally recognized reserves of Cacouna or Whithworth (located about 35 km south-west of Cacouna); (Figure 2-2). Approximately 4,000 members (Cacouna.Quebec 2004) of the Malecite Nation exist in New Brunswick; however, none of the communities/reserves are adjacent to the Gulf of St. Lawrence.

2.4.4 Métis

The Labrador Métis are a group of approximately 5,000 people of mixed Inuit and European ancestry who reside primarily within 14 small communities along the south coast of Labrador from Cartwright to Red Bay. In 1985, the Métis people formed the Labrador Métis Nation (LMN) which has worked to pursue formal recognition of the Métis people and the subsequent development of Métis Land claims within southern and central Labrador (Labrador Métis Nation 2004).

2.5 INSTITUTIONAL/INDUSTRY AND ENVIRONMENTAL ORGANIZATIONS

There are numerous non-governmental organizations throughout the Gulf of St. Lawrence that share an interest in the management of marine activities and resources including economic development boards and associations, environmental, stewardship and conservation groups, academic and research institutions, and industry associations.

2.5.1 Economic Development Boards and Associations

Economic development boards and associations throughout the Gulf of St. Lawrence focus on the socio-economic significance of coastal and marine resources and activities. Economic development boards and associations are coordinated at the provincial level but operate on a local scale. Working closely with federal, provincial and municipal governments; economic development boards and associations support the socio-economic interests of municipalities within their respective economic zones (Newfoundland and Labrador), counties (Nova Scotia, New Brunswick, Prince Edward Island) and administrative regions (Quebec); (Table 2-6).

Table 2-6 Economic zones, counties and administrative regions bordering the Gulf of St. Lawrence.

Province	Economic Area
Newfoundland and Labrador	**Economic Zone**
	Economic Zone 05; Economic Zone 06; Economic Zone 07; Economic Zone 08; Economic Zone 09; Economic Zone 10
Quebec	**Administrative Regions**
	Côte-Nord; Saguenay-Lac-Saint-Jean; Capitale-Nationale; Chaudière-Appalaches; Bas-Saint-Laurent Administrative; Gaspésie-Îles-de-la-Madeleine
New Brunswick	**County**
	Restigouche County; Gloucester County; Northumberland County; Kent County; Westmorland County
Nova Scotia	Cumberland County; Colchester County; Pictou County; Antigonish County; Inverness County
Prince Edward Island	Kings County; Queens County; Prince County

2.5.2 Environmental, Stewardship and Conservation Groups

Environmental, stewardship and conservation groups throughout the Gulf of St. Lawrence focus on the management, conservation and protection of coastal and marine resources and ecosystems. These groups generally operate at a local or provincial scale, capitalizing on support and resources from federal and provincial governments.

Quebec (Gingras and Dalcourt 2003) is well advanced in this area, undertaking a review of community based integrated coastal zone management initiatives that were initiated within the province between 1996 and 2002 (Gingras and Dalcourt 2003). This review has highlighted the vital role that interest groups and stakeholders play within such initiatives, and some of the challenges associated with collaborative approaches and planning processes. The Saint-Laurent Vision 2000 is a joint federal, provincial and non-governmental program which has evolved from previous governmental and non-governmental joint ventures that focused efforts on the clean up of the St. Lawrence estuary (St. Lawrence Vision 2000. 2004). The focus of Saint-Laurent Vision 2000 is to ensure the protection of ecosystems and human health, and encourage involvement of coastal communities to facilitate rehabilitation and local use of the St. Lawrence estuary. This commitment was reinforced through the establishment of three priority intervention zones/zones d'intervention prioritaires (ZIP) throughout the St. Lawrence estuary and another three in Baie des Chaleurs and along the Îles-de-la-Madeleine, and Quebec North Shore, each managed by a local ZIP committee which represents communities within their respective zones. The Saint-Laurent Vision 2000 is probably the most successful example of integrated management in Québec. Stratégies Saint-Laurent, a partner of the Saint-Laurent Vision 2000 program, represent 25 organizations including ZIP committees and environmental groups with interest in the Gulf of St. Lawrence. Plein Cap sur la Mer

represents the maritime regions of Quebec, focusing on identifying and grouping together enterprises and research centres specializing in the marine sector (Gouvernement du Québec 2002*a*). There are a number of other groups within Quebec who focus their efforts on the rehabilitation and conservation of the Gulf of St. Lawrence and estuary, and numerous watersheds associated with the Gulf of St. Lawrence.

A number of coastal and marine conservation initiatives exist along eastern New Brunswick, the north shore of Nova Scotia, Prince Edward Island and western Newfoundland and Labrador. Numerous community, industry and environmental groups and organizations work together with government to develop and implement measures to manage ocean and coastal activities. The Atlantic Coastal Action Program (ACAP) is a community-based program initiated by Environment Canada in 1991 (Environment Canada 2004*b*). The program encourages the involvement of communities, industry and other stakeholders at the local level in the decision making on sustainable coastal initiatives. Five ACAP initiatives currently exist throughout the Gulf of St. Lawrence: Miramichi River Environmental Assessment Committee (New Brunswick), Pictou Harbour Environmental Protection Association (Nova Scotia), Bedeque Bay Environmental Management Association and Southeast Environmental Association (Prince Edward Island), and Humber Arm Environmental Association (Newfoundland and Labrador).

2.5.3 Academic and Research Institutions

A number of academic institutions throughout the Gulf of St. Lawrence provide educational and research programs directed at marine related activities. Academic and research institutions develop modern technology to support ocean activities, and provide scientific advice to government and industry on ocean related matters.

2.5.4 Industry Associations and Committees

There are numerous industry associations at the local, provincial and national scale that have interest in the development and management of coastal and marine industry activities in the Gulf of St. Lawrence. These include industry unions, committees, and associations supporting the development of the commercial fishing, oil and gas, aquaculture, pulp and paper, and shipping industries just to name a few.

2.6 SUMMARY

The complex governance structure throughout the Gulf of St. Lawrence provides both challenges and opportunities toward better managing coastal and marine activities. The greatest challenge is presented through the multi-jurisdictional setting and the multitude of existing legislation. Does existing legislation meet the challenges of evolving coastal and marine activities? Legislation is not necessarily consistent among the five provinces and the federal government. Is there a need to conduct a regulatory review to identify overlaps in legislation and find common approaches towards managing and regulating coastal and marine activities? Interest groups such as Aboriginal groups, environmental and stewardship groups, academic and research institutions, economic development associations, industry associations and municipalities share a common interest in the management of coastal and marine activities. Any regulatory review should include the views of these groups.

3.0 HUMAN SETTLEMENTS

3.1 INTRODUCTION

The objective of this section is to provide an overview of human settlement patterns along the coastal areas of the Gulf of St. Lawrence, accompanied with a demographic and socio-economic profile of coastal populations.

The 2001 population census conducted by Statistics Canada was the primary source of information (Statistics Canada 2001*b*). Census data was available at four scales of spatial resolution: provincial (5 coastal provinces), economic regions (12 coastal economic regions), census divisions or counties (39 coastal census divisions), and census subdivisions (401 coastal census subdivisions). As the three larger-scale spatial entities included large portions of non-coastal territory and many non-coastal communities, it was decided to use census subdivisions (municipalities) as the primary scale for data acquisition. A total of 401 census subdivisions border the Gulf of St. Lawrence.

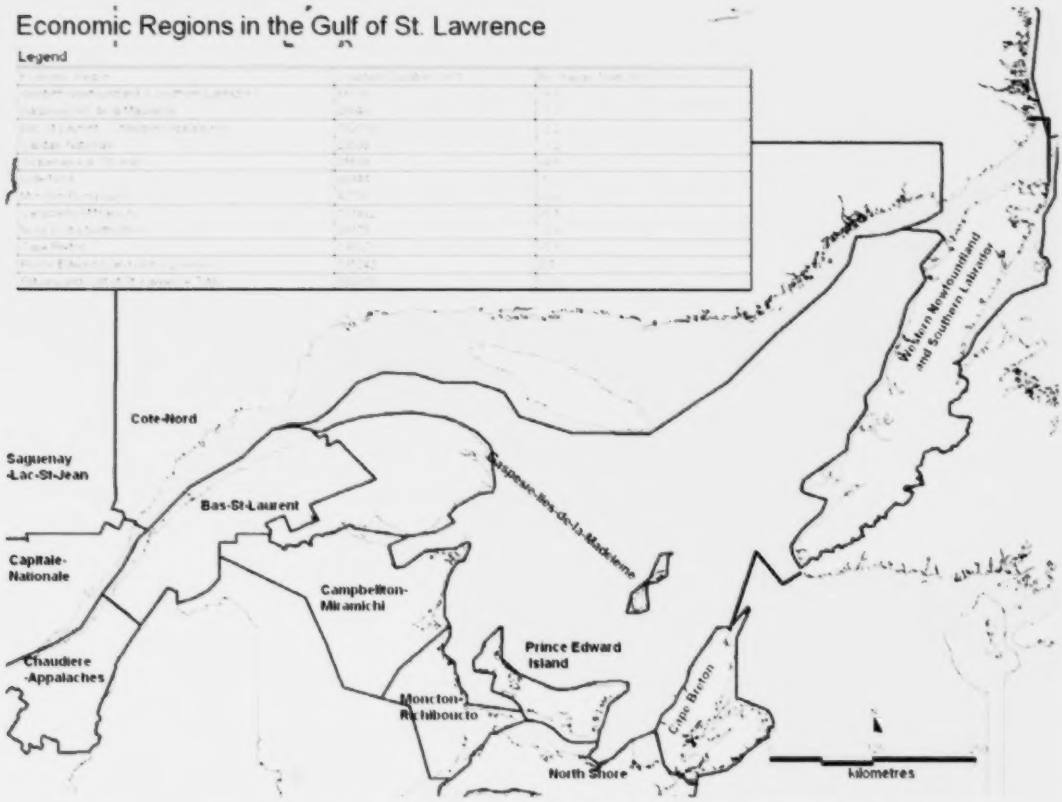


Figure 3-1 Economic regions bordering the Gulf of St. Lawrence with 2001 population data for only the coastal portion of each economic region.

Data for 401 coastal subdivisions were grouped together according to the 12 economic regions (Figure 3-1) adjacent to the Gulf of St. Lawrence. As one region (Chaudière-Appalaches, in Quebec) included only six coastal subdivisions (municipalities), it was grouped together with the adjacent Bas-St-Laurent economic region. It is important to note that this pooled regional data is not representative of each economic region, but only of its coastal census subdivisions, excluding all non-coastal subdivisions. The only exception to this is Prince Edward Island, where the entire population of the province was included in the analysis since coastal subdivisions covered virtually the entire province.

3.2 DEMOGRAPHIC PROFILE

For each of these coastal census subdivisions, population data was summarized for the following variables: 2001 population (population size and density); population variation from 1996 to 2001 (to determine demographic evolution); area of subdivision (to calculate population density); age structure of the population; education level; land language spoken at home (Statistics Canada 2001*b*).

3.2.1 Population Size and Distribution

According to the 2001 census, the total population of the 401 coastal census subdivisions (mostly municipalities) was 858,310, which represented 2.86% of the total Canadian population. Rural areas and small communities still occupy a large portion of the population, with urban centres being relatively small (Figure 3-2).

The total population includes several small inhabited islands (excluding the islands of Newfoundland and Prince Edward Island) with a total population of 14,611. These are: Îles-de-la-Madeleine (several communities, total population 12,824), Anticosti Island (community of Port-Meunier, population 266), Ile Verte (community of Notre-Dame-des-Sept-Douleurs, population 44), Ile-aux-Coudres (several communities, total population 1,319), Ile-aux-Grues (community of Saint-Antoine-de-l'Isle-aux-Grues, population 158). Due to their relative isolation, island communities are particularly dependent on the marine environment, whether it is for their natural resources, transportation of goods or economic development. Whether or not island communities have a lesser or greater impact on the shoreline and marine environment than rural areas is unknown.

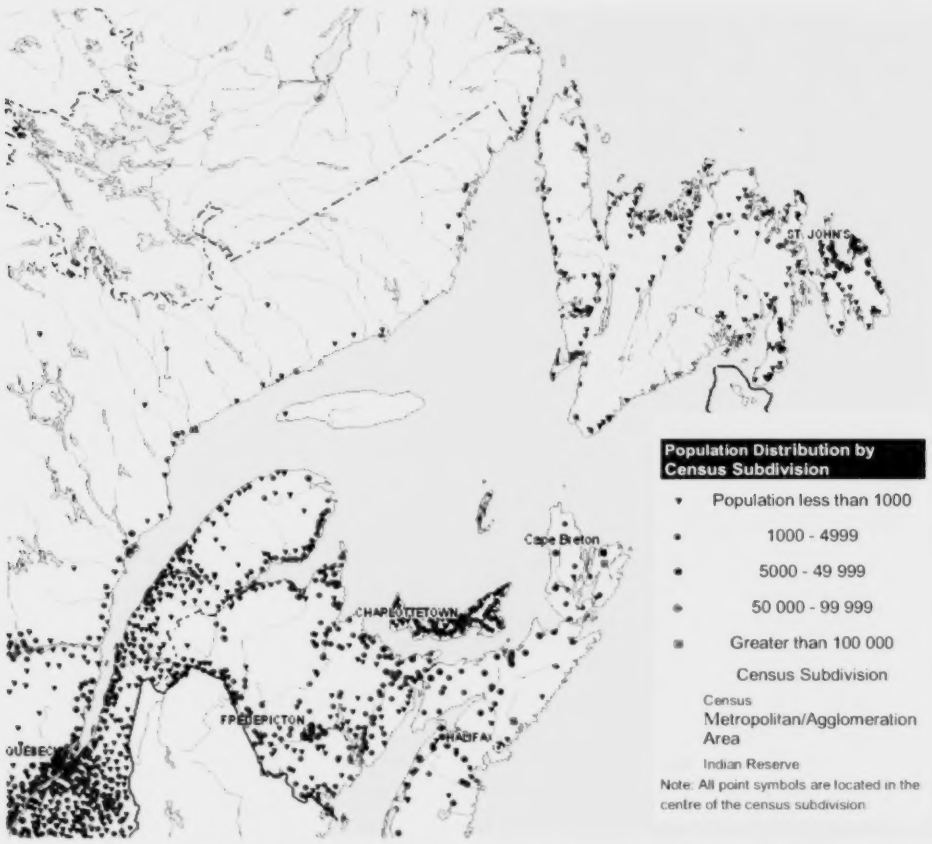


Figure 3-2 Distribution of population along the Gulf of St. Lawrence. (Courtesy of Natural Resources Canada 2001).

3.2 DEMOGRAPHIC PROFILE

For each of these coastal census subdivisions, population data was summarized for the following variables: 2001 population (population size and density); population variation from 1996 to 2001 (to determine demographic evolution); area of subdivision (to calculate population density); age structure of the population; education level; land language spoken at home (Statistics Canada 2001*b*).

3.2.1 Population Size and Distribution

According to the 2001 census, the total population of the 401 coastal census subdivisions (mostly municipalities) was 858,310, which represented 2.86% of the total Canadian population. Rural areas and small communities still occupy a large portion of the population, with urban centres being relatively small (Figure 3-2).

The total population includes several small inhabited islands (excluding the islands of Newfoundland and Prince Edward Island) with a total population of 14,611. These are: Îles-de-la-Madeleine (several communities, total population 12,824), Anticosti Island (community of Port-Meunier, population 266), Ile Verte (community of Notre-Dame-des-Sept-Douleurs, population 44), Ile-aux-Coudres (several communities, total population 1,319), Ile-aux-Grues (community of Saint-Antoine-de-l'Isle-aux-Grues, population 158). Due to their relative isolation, island communities are particularly dependent on the marine environment, whether it is for their natural resources, transportation of goods or economic development. Whether or not island communities have a lesser or greater impact on the shoreline and marine environment than rural areas is unknown.

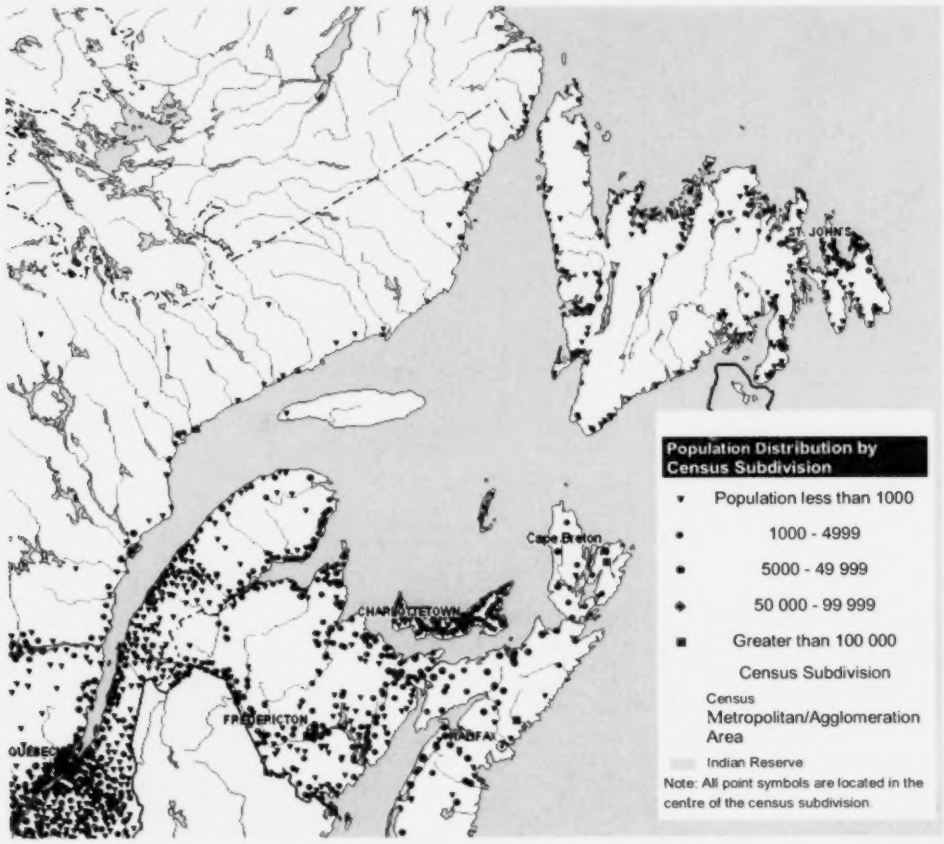


Figure 3-2 Distribution of population along the Gulf of St. Lawrence. (Courtesy of Natural Resources Canada 2001).

3.2.2 Population Density

The average population density in the 401 coastal census subdivisions was 9.9 inhabitants per km^2; three times the Canadian average (Table 3-1). The highest density was in Prince Edward Island (23.8 inhabitants per km^2) and along the southern shore of the estuary (coastal portions of the Bas-St-Laurent + Chaudière-Appalaches region: 47.4 inhabitants per km^2). The lowest densities were along the coasts of western Newfoundland and southern Labrador (3.4 inhabitants per km^2) and along the Quebec Côte-Nord (North Shore) region (3.6 inhabitants per km^2).

It is important to note that the actual densities along the shoreline were probably much greater than suggested by the data, since within most municipalities, dwellings are usually concentrated along the shores, with lower densities inland. This pattern of development was likely influenced by the early development of the commercial fishing industry. In fact, during the past few years, the interest for shoreline residential and cottage areas has risen substantially in many coastal areas of the Gulf of St-Lawrence. As a result, the value of shoreline properties and the number of new constructions has risen dramatically in many areas. This is of course accompanied by an increased pressure on the shoreline environment.

Unfortunately, data on the actual density of dwellings along the shores was not available. Nevertheless, the density data presented here give a good idea of the relative densities among regions, which in turn give a measure of the relative impact these populations might have on the marine environment.

Table 3-1 Demographic data for the coastal portions of the 12 economic regions bordering the Gulf of St Lawrence, and Canada as a whole. Note that since there were only six coastal municipalities in the Chaudière-Appalaches region, it was grouped together with the adjacent Bas-St-Laurent region.

Variable	NL	QC					NB		NS		PEI	Estuary and Gulf Total	Canada
	west NF & south Labrador	Gaspésie-Îles-de-la-Madeleine	Bas-St-Laurent + Chaudière-Appalaches	Capitale-Nationale	Saguenay-Lac-St-Jean	Côte-Nord	Moncton-Richibouctou	Campbellton-Miramichi	NS North Shore	Cape Breton	PEI (entire province)		
Number of municipalities or census subdivisions	57	48	42	11	7	42	19	43	17	4	111	**401**	
Population													
Total population in 2001	65,776	91,640	132,779	23,599	25,699	93,444	42,728	131,922	96,179	19,302	135,242	**858,310**	**3.0E+07**
% variation - 1996 to 2001	-9.8	-7.5	-2.2	-1.2	-4.8	-5.3	-0.3	-5.1	-1.9	-5.1	0.5	**-3.8**	**4.0**
Density (people / km^2)	3.4	13.9	47.4	12.1	11.3	3.6	16.3	17.6	12.8	5.0	23.8	**9.9**	**3.3**
Age distribution													
% < 15 years old	16.9	16.3	15.3	15.1	18.4	19.1	15.5	16.5	18.6	18.4	19.7	**17.3**	**19.1**
% 15 to 60 years old	64.5	62.8	63.4	62.6	65.0	66.2	63.8	64.7	61.8	61.1	62.3	**63.6**	**63.7**
% > 60 years old	18.5	21.0	21.4	22.4	16.6	14.6	20.7	18.8	19.6	20.6	18.2	**19.1**	**17.2**
Education (pop. > 20 years old)													
% with less than 9th grade	20.2	27.9	18.9	24.2	16.5	21.7	24.2	22.0	9.1	12.4	11.3	**18.7**	**10.5**
% with bacchelor's degree or higher	7.7	6.9	12.2	8.2	7.9	7.7	8.4	9.1	12.0	9.7	12.6	**9.9**	**16.9**
Language spoken at home (%)													
English only	98.6	7.3	0.1	0.1	0.4	4.2	21.0	33.0	97.5	83.5	95.2	**42.9**	**61.6**
French only	0.1	86.6	98.3	98.8	96.7	85.3	57.2	52.1	0.2	8.2	1.2	**50.5**	**19.8**
English & French	0.9	5.2	1.5	1.1	2.6	3.0	21.1	14.2	1.1	7.1	2.7	**5.2**	**3.4**
Others (non official language only or with english or french)	0.4	0.8	0.1	0.1	0.3	7.6	0.6	0.7	1.3	1.1	0.9	**1.4**	**15.2**

Source: Preliminary data courtesy of Statistics Canada 2005.

3.2.3 Demographic Evolution

Between 1996 and 2001, the population along the Gulf of St. Lawrence declined by 3.8% (Table 3-1). This decline was common to the coastal parts of all 12 economic regions in the study area, except for Prince Edward Island, where the population increased by 0.5%. The greatest declines occurred in the western Newfoundland and southern Labrador (-9.8%) and the Gaspesie-Iles-de-la-Madeleine (-7.5%) regions.

This decline was in contrast to Canadian average where the population increased by 4% between 1996 and 2001. This increase probably reflects an increase of immigrants from other countries, mostly to urban centres.

3.2.4 Age Structure

The 2001 census indicated that 17.3% of the population was below 15 years of age (Table 3-1), about 9% lower than the Canadian average (19.1%), reflecting lower birth rates in the last 15 years. By contrast, the percentage of the population above 60 years of age was 11% higher than the Canadian average. The percentage of the population between 15 and 60 years of age (mostly the active population) was almost the same as the Canadian average. This data suggests that the population in the

study area is aging at an even greater rate than is the case in Canada as a whole or perhaps reflects out-migration of the active workforce (younger families).

It should be noted that Aboriginal communities generally displayed the opposite age structure. In most cases, over 30% of Aboriginal populations were less than 15 years of age, due to very high birth rates. In some cases, as much as 40% are less than 15 years of age (Pakuashipi [40.0%] and Natashquan [40.8%]). In contrast, the percentage aged 60 and over is usually below 8% (Statistics Canada, 2001), less than half that for Gulf of St. Lawrence as a whole.

3.2.5 Education

The census data indicated that 18.7% of the population had achieved less than a grade nine level education in 2001 which was substantially higher (43%) than the Canadian average (Table 3-1). In addition, only 9.9% of the population had obtained a university degree (bachelor's or higher), substantially less (72%) than the Canadian average. These differences were even greater in the coastal portions of the Gaspésie-Iles-de-la-Madeleine region, where as much as 27.9% of population had not reached the grade nine level and as few as 6.9% had obtained a university degree.

Even in regions displaying the highest levels of education within the study area (Prince Edward Island and the coastal portion of the North Shore region of Nova Scotia), the proportion of the population that had obtained a university degree was still lower than the Canadian average (12.6% in Prince Edward Island and 12.0% along the North Shore of Nova Scotia, vs. 16.9% in Canada). This may reflect a lower accessibility to higher education within the study area, as it is mostly a rural part of Canada, with only smaller urban centres or perhaps an out-migration of the more educated portion of the workforce. This lower level of education probably reflects the older portion of the population, which is 11% (above 60 years of age) higher along the Gulf of St. Lawrence compared to the Canadian average.

3.2.6 Language Spoken at Home

In the 2001 census, 42.9% of the population in the study area declared they spoke only English at home, 50.5% only French, 5.2% both English and French, and only 1.4% declared they spoken another non-official language, either on its own, or in combination with English and/or French (Table 3-1). This diversity in language use mainly followed provincial boundaries with the vast majority of the population in Quebec using only French at home and the majority in other provinces using only English. The exception was in New Brunswick where Moncton-Richiboucto (21.1%) and Campbellton-Miramichi (14.2%) had the highest use of both French and English at home among the 12 economic regions. Use of languages other than French and English was highest in the Quebec Côte-Nord (North Shore) region (Table 3-1) where 91% of the 7,100 Innu populations spoke their own language at home, either on its own, or in conjunction with French (or sometimes with English).

3.3 SOCIO-ECONOMIC PROFILE

For each of the coastal census subdivisions, socio-economic data was summarized for the following variables: workforce activity data (active, inactive, employed and unemployed population); average income and distribution of population by income levels; composition of income (employment income vs. government transfers); and work force classification by industry (Statistics Canada 2001*b*).

3.3.1 Employment

The workforce participation rate (% of population >15 years of age that is active; excludes students, retirees and chronically unemployed people such as those on welfare) in 2001 was 60.3%, only slightly lower than the Canadian average of 66.4% (Table 3-2). In contrast, the unemployment rate (15.9%) was twice as high as the Canadian average (7.4%).

The lowest participation rate and greatest unemployment rate were recorded for western Newfoundland and southern Labrador (participation rate: 54.1%; unemployment rate: 28.0%). Prince Edward Island was the only region which had a participation rate higher than the Canadian average (69.0% vs. 66.4%). The coastal portions of the Bas-St-Laurent and Chaudière-Appalaches regions had the lowest unemployment rate within the study area (10.3%). However, even this was substantially higher than the Canadian average (7.4%), perhaps underlining both the scarcity and the seasonal nature of the work.

Table 3-2 Socio-economic data for coastal portions of 12 economic regions bordering the Gulf of St. Lawrence and Canada as a whole. Note: the six coastal municipalities in the Chaudière-Appalaches region were combined with the adjacent Bas-St-Laurent region.

Variable	NL	QC					NB		NS		PEI	Estuary and Gulf Total	Canada
	west NF & south Labrador	Gaspésie-Îles-de-la-Madeleine	Bas-St-Laurent + Chaudière-Appalaches	Capitale-Nationale	Saguenay-Lac-St-Jean	Côte-Nord	Moncton-Richibouctc	Campbellton-Miramichi	NS North Shore	Cape Breton	PEI (entire province)		
Employment (pop. > 15 years old)													
Participation rate (%)	54.1	53.8	60.8	57.0	58.6	61.7	63.3	57.7	60.9	58.9	69.0	**60.3**	**66.4**
Employment rate (%)	39.0	41.9	54.5	49.2	50.2	51.9	51.7	48.1	52.9	47.4	60.0	**50.7**	**61.5**
Unemployment rate (%)	28.0	22.2	10.3	13.6	14.2	15.9	18.4	16.6	13.1	19.5	13.1	**15.9**	**7.4**
Income (pop. > 15 years old)													
Average income ($)	19963	21226	23811	21721	24123	26486	21859	21671	24213	22782	23769	**23059**	**29769**
% with income < 15 000 $	55.1	51.4	45.0	49.1	50.0	45.2	44.6	51.3	47.3	49.3	41.5	**47.5**	**39.2**
Composition of income													
Employment income (%)	64.0	65.2	70.8	69.4	75.8	77.6	67.7	67.9	71.4	65.4	70.8	**70.1**	**77.1**
Transfer payments (%)	26.4	26.9	17.9	21.2	15.5	15.4	22.5	23.1	17.4	22.5	18.5	**20.2**	**11.6**
Other sources (%)	9.5	7.9	11.3	9.4	8.7	7.0	9.8	9.0	11.3	12.0	10.7	**9.7**	**11.3**
Work force by industry (%)													
Resource-based industries (e.g.: fisheries, agriculture, forestry...)	11.6	12.8	6.1	6.5	5.4	12.7	7.9	11.0	9.2	13.5	13.5	**10.5**	**5.5**
Manufacturing and construction	17.2	16.4	18.5	15.4	25.6	21.2	32.8	21.3	23.4	20.3	17.8	**20.3**	**19.6**
Wholesale and retail trade	17.8	13.3	16.4	12.1	15.1	13.7	12.2	14.5	18.0	15.7	13.6	**14.9**	**15.7**
Finance and real estate	2.4	3.1	4.4	3.4	2.3	3.1	3.2	3.3	3.0	2.7	2.8	**3.2**	**5.7**
Health and education	20.2	20.8	20.8	21.8	14.3	17.3	14.4	20.2	18.5	16.3	16.2	**18.6**	**16.3**
Buisiness services	9.3	9.2	12.8	11.4	11.1	10.0	11.3	9.6	10.8	9.4	11.4	**10.7**	**17.9**
Other services	21.1	24.3	20.8	29.5	26.1	22.1	18.5	20.1	17.3	22.0	24.7	**21.8**	**19.3**

Source: Preliminary data courtesy of Statistics Canada 2005.

3.3.2 Structure of Workforce by Industry

Resource-based industries such as agriculture, fisheries, forestry and mining employed 10.5% of the active work force in 2001, almost twice the Canadian average (Table 3-2). Manufacturing and construction was the largest employer (20.3%), slightly above the Canadian average, while employment in business services (10.7%) and finance and real estate (3.2%) were below the Canadian average.

Many primary resource sector industries provide mostly seasonal work and often lower income. This may help explain the lower average income, lower employment rate and higher dependence on transfer payments in the study area when compared to Canada as a whole. This is especially true when we consider the dwindling marine and forest resources in and around the Gulf of St. Lawrence, as well as the increasingly global and competitive agricultural markets. Meanwhile, more favourable incomes are often supported through unionized jobs and stronger product markets.

3.3.3 Income

The average income in 2001 was $23,059 in 2001, 22% less than the Canadian average (Table 3-2). The lowest average income was in the western Newfoundland and in southern Labrador region ($19,963), 33% less than the Canadian average, while it was highest along the Quebec Côte-Nord (North Shore) region ($26,486), 11% lower than the Canadian average. It should be noted that along the Quebec Côte-Nord (North Shore) region, highest incomes were earned by people living in the urban and industrial areas of Baie-Comeau, Port-Cartier, Sept-Îles and Havre-St-Pierre, with the rest of the population earning, in general, much less.

It is of interest to note that 47.5% of the population along the Gulf of St. Lawrence earned less than $15,000, compared to 39.2% in Canada as a whole. In western Newfoundland and southern Labrador, 55.1% of the population earned less than $15,000. In Prince Edward Island, which had the lowest proportion of people earning less than $15,000 (41.5%), this figure was still higher than the Canadian average (39.2%).

It should be noted here that the relatively lower average income compared to the Canadian average is counterbalanced (at least in part) by a relatively lower cost of housing and other living expenses on average due to the predominantly rural and small urban centres.

3.4 SUMMARY

Based on the data presented, one may conclude that the coastal areas adjacent to the Gulf of St. Lawrence have been experiencing a lower level of socio-economic prosperity than the rest of Canada. This is illustrated by a lower participation rate in the work force (60.3% in the study area vs. 66.4% in Canada as a whole), a higher unemployment rate (15.9% vs. 7.4%), a lower average income ($23,059 vs. $29,769), a greater proportion of people earning less than $15,000 (47.5% vs. 39.2%), and a greater dependence on transfer payments (20.2% vs. 11.6% of average income). This reduced level of economic opportunity may help explain the population drop of 3.8% along the Gulf of St. Lawrence between 1996 and 2001, which is reflected by the out migration of an active workforce, a low birth rate and an aging population in rural areas. Meanwhile, the 4% increase in the Canadian population may be attributed to other factors: a higher birthrate and an increase of immigrants from other countries.

The relatively lower level of socio-economic prosperity in the Gulf of St. Lawrence (compared to Canada as a whole) seems to be correlated with two variables: lower level of formal education and the importance of the primary sector. First, the percentage of the population without a formal secondary education is much higher than the Canadian average (18.7% vs. 10.5% in Canada as a whole) while the population with a university degree is much lower (9.9% vs. 16.9%). Second, the economic structure in the study area is skewed towards the primary sector, with 10.5% of the active population working in resource-based industries (such as fisheries, agriculture and forestry), compared to the Canadian average of 5.5%. These variables raise a number of questions: Does this lower level of formal education reflect the lack of educational opportunity within rural areas or have much of the active workforce with a more formal education emigrated to areas providing a higher level of economic opportunity? In the past, with the economic structure geared towards the primary sector, there may not have been a requirement for a more formal education. This trend is generally reflected in the retired population and the older portion of the active workforce.

While the economic structure of coastal communities along the Gulf of St. Lawrence is based mainly around primary industries, many depend solely on one industry such as fisheries, forestry or mining. Single industry communities have a difficult time recovering from adverse changes in an industry, such as the closure of the commercial cod fishery in the Gulf of St. Lawrence during the early 1990's. The downturn in a major industry is often followed by an out migration of an active workforce. The future of many coastal communities may depend on how well the principles of conservation and precautionary approach are integrated into municipal and coastal planning, and the ability to capitalize on emerging industries.

4.0 HUMAN/INDUSTRIAL ACTIVITIES

4.1 INTRODUCTION

One of the integral elements of integrated management is identifying, describing and understanding existing or potential activities that either take place within coastal, marine and estuarine areas or which rely on the resources present within these areas. The United Nations Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) indicates that with respect to marine environments, globally, the greatest harm is often caused by what we do on land and particularly at the coast rather than at sea (GESAMP 2001).

Within each of the provinces bordering the Gulf of St. Lawrence there are a myriad of ongoing human and/or industrial activities which have the potential to impact or interact with the physical and biological components of the marine environment. These range from commercial fishing and marine shipping to municipal wastewater disposal and agriculture. This document provides an overview of 12 marine and land-based activities that have the potential to impact the Gulf of St. Lawrence ecosystem. Early within the development of the Human Systems Overview Report it was realized that, rather than attempting to research and describe every possible human and/or industrial activity occurring within or adjacent to the Gulf of St. Lawrence, it would be more productive to focus on activities which represent the greatest potential to interact with and influence the ecological function of the Gulf of St. Lawrence. These activities include: i) commercial fishing; ii) aquaculture; iii) oil and gas exploration; iv) marine transportation; v) coastal and marine tourism and recreation; and vi) land based activities including municipal wastewater disposal, pulp and paper production, mining and mineral processing, fish processing, agriculture, dredging and freshwater modulation.

Many other human and/or industrial activities including forest harvesting, ocean disposal, cable and pipeline corridors, recreational and Aboriginal fishing, and oil storage facilities also occur within or adjacent to the Gulf of St. Lawrence and estuary. However, these have not been included in the current version of the Human Systems Overview Report. This report is a living document, as such subsequent versions should strive to fill and address these gaps.

The purpose of the Human Industrial Activities section is to present a general description of the foremost human and/or industrial activities that occur adjacent or within the Gulf of St. Lawrence that are likely to exert some influence or effect on the ecological, biological and physical, aspects of this ecosystem.

4.2 COMMERCIAL FISHING

4.2.1 Background

The significance of the commercial fishing industry is reflected through a long history of coastal settlement along the Gulf of St. Lawrence, where marine fisheries have been the primary economic drivers since European immigrants began settling here more than 500 years ago. The commercial fishing industry has evolved immensely over this period with the most significant changes and challenges occurring over the past 30 years or so. More efficient diesel driven fleets employing side and stern trawls replaced sail and steam driven fleets. More efficient fishing practices and over-fishing resulted in a need for stringent resource management practices. Prior to 1977, both foreign and domestic fleets employing bottom trawls heavily exploited Northwest Atlantic waters including the Gulf of St. Lawrence. In 1977, the United Nations Law of Sea Convention set a 200 mile exclusive economic zone around Canada, turning over the authority for fishery resources within this zone to the Government of Canada and allowing only Canadian registered fleets to fish (The United Nations Convention for the Law at Sea 1998). Canadian fleets employing bottom trawls rapidly increased, replacing the foreign fleets and continuing to over exploit resources until the early 1990's. In 1979, the International Commission for the Northwest Atlantic Fisheries (ICNAF) was replaced by the Northwest Atlantic Fisheries Organisation (NAFO), a fisheries body that incorporates scientific advice

and management initiatives of its members. NAFO provides a statistical system of fishing area delineation throughout the north Atlantic (Figure 4-1) based on the distribution of important commercial stocks such as cod and haddock (Northwest Atlantic Fisheries Organization 1979). By the early 1990's, Atlantic salmon, Atlantic cod and redfish had already experienced significant reductions in stock biomass and were placed under moratoria. These species have yet to show indications of stock biomass returning to levels experienced during the 1960's and 1970's. In 2003, COSEWIC suggested that the Laurentian cod stock, along with a number of other Atlantic cod stocks, should be considered for protection under the Species at Risk Act (SARA). This decision was overturned by the Minister of Fisheries and Oceans in the spring of 2006, due to a recovery plan being put in place (Fisheries and Oceans 2006). A number of factors contributing to the collapse of groundfish stocks include adverse fishing practices, mismanagement of stocks, predation by an escalating harp seal population, and global warming, just to name a few. Bottom trawlers dominated the Atlantic cod fishery prior to the 1990's, accounting for much of the annual catch of Atlantic cod in the Gulf of St. Lawrence (approximately160,000t (tonnes) annually). Improved technology allowed fleets to find and exploit greater concentrations of fish. Catches were often misreported and large by-catches of cod were often taken while harvesting other species (Manson 2002). The Government of Canada was often criticized for ignoring warnings from the scientific community, and setting Total Allowable Catches (TAC) too high, even when cod stocks were already in drastic decline.

The data presented in this document represents fish landings and values from 1997 to 2001 and is weighed against data for 1990-1991; just prior to any moratorium being put in place. While this data gives a sense of value to the fishery over that time period, it would be interesting to identify trends in the fishery over a longer period (30 – 40 years). Similarly, the availability of "catch data" over the same period may identify major targeted fishing areas or movement of fishing effort over time. Unfortunately, catch data for the Gulf and Quebec regions was not available at time of writing.

NAFO Areas and Sub-Divisions in the Gulf of St. Lawrence

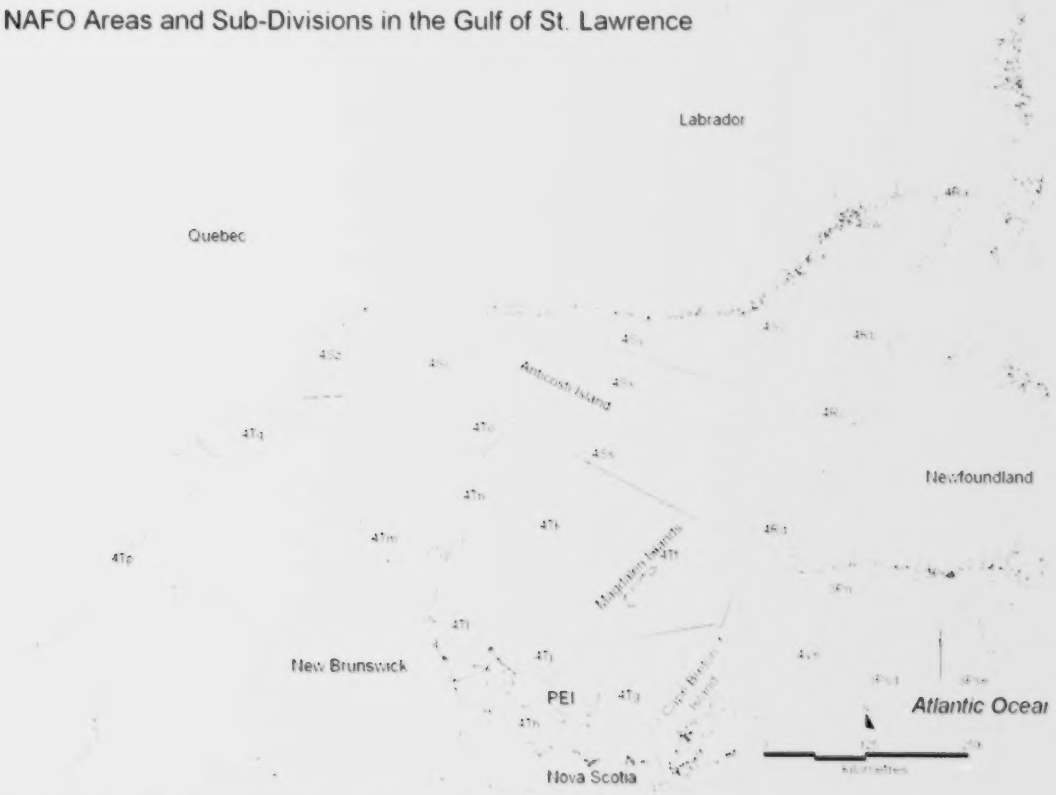


Figure 4-1 NAFO areas and sub-divisions within the Gulf of St. Lawrence.

Fisheries and Oceans Canada (DFO) is the lead regulatory agency for fisheries (including seals) management within Canadian waters, obtaining its authority from the Fisheries Act and associated regulations. In Quebec, the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation (MAPAQ), is responsible for the management and regulation of the commercial fisheries for freshwater and diadromous species (Gouvernement du Québec 2004b). Within the Gulf of St. Lawrence, the provincial governments of Newfoundland and Labrador, Quebec, New Brunswick, Nova Scotia and Prince Edward Island also play a key role in economic development and resource use by supporting fishery conservation and sustainability.

Management efforts are based on careful considerations of all information, including traditional knowledge, local knowledge, industry experience, and scientific information available from both DFO and external organisations. The Fisheries Resource Conservation Council is a federal advisory committee, which makes public recommendations to the Minister of Fisheries and Oceans regarding conservation measures for future fisheries (Fisheries Resource Conservation Council 2004). Similarly, the Canadian Sealers Association communicates their position on the seal hunt, playing an important role in offering an alternative perspective on the seal hunt to the media and others. The Gulf Groundfish Advisory Committee, Small Pelagics Advisory Committees, Atlantic Large Pelagic Advisory Committee and the Gulf Shrimp Advisory Committee, comprised of representatives from government (federal/provincial), the fishing industry (fish harvesters, processors, and fisheries unions) and Aboriginal communities, contribute to the consultation process on sustainable fishing practices and future fisheries. A number of joint DFO and provincial advisory committees also exist throughout the Gulf of St. Lawrence, contributing to the consultation process for Gulf-wide and local fisheries. Management of commercial fisheries consists of a complex network of conservation strategies and restrictions based on consultations and recommendations of stakeholders. DFO provides factual and up-to-date information to the Minister, diplomatic posts, foreign and domestic media, businesses, government representatives and citizens through news releases, fact sheets, backgrounders and DFO's website (Fisheries and Oceans Canada 2004a).

4.2.2 Groundfish, Pelagics, Shellfish, Marine Plants

Decades of heavy exploitation eventually resulted in a decline in salmon, cod and redfish stocks during the early 1990's. A major change occurred in the management of these stocks in 1992 when a commercial salmon fishery moratorium was introduced followed by a commercial cod fishery moratorium in 1993 and redfish in 1995. Thousands of jobs were lost from the commercial fishing industry. The loss of what had been for centuries the key economic driver in most coastal communities adjacent to the Gulf of St. Lawrence, was mitigated somewhat by government funded retraining programs for fish harvesters, but unable to find work locally, many families simply packed up and moved to larger centres. With fewer professional fish harvesters, the fishing industry soon adapted. The focus broadened to target a number of previously underutilized species and learning from the mistakes of the past, fisheries management practices were adjusted. Gear restrictions, quotas and closed areas were introduced as well as limitations on the amount of by-catch.

Available fisheries landings and landed values collected by Fisheries and Oceans Canada, Policy and Economics Branch, Statistics Division for NAFO sub divisions 4RST (Fig. 4-1) in 1997-2001 were used to give an overview of recent commercial fishing activity in the Gulf of St. Lawrence. With the exception of seals, annual commercial landings of all species in the Gulf of St. Lawrence averaged 223,069t in 1997-2001 (Fisheries and Oceans Canada 2004*b*). The total landed value was just over $467 million. Herring, shrimp, snow crab, lobster and mackerel were the top five contributors to landings, accounting for 76% of the total (Fig. 4-2). However, in terms of landed value, lobster, snow crab, shrimp, herring and cod were the top five species accounting for 88%. Herring accounted for the single highest percentage (36%) of landings (Fig 4-2), but lobster contributed the highest value (50%) overall (Fig. 4-3).

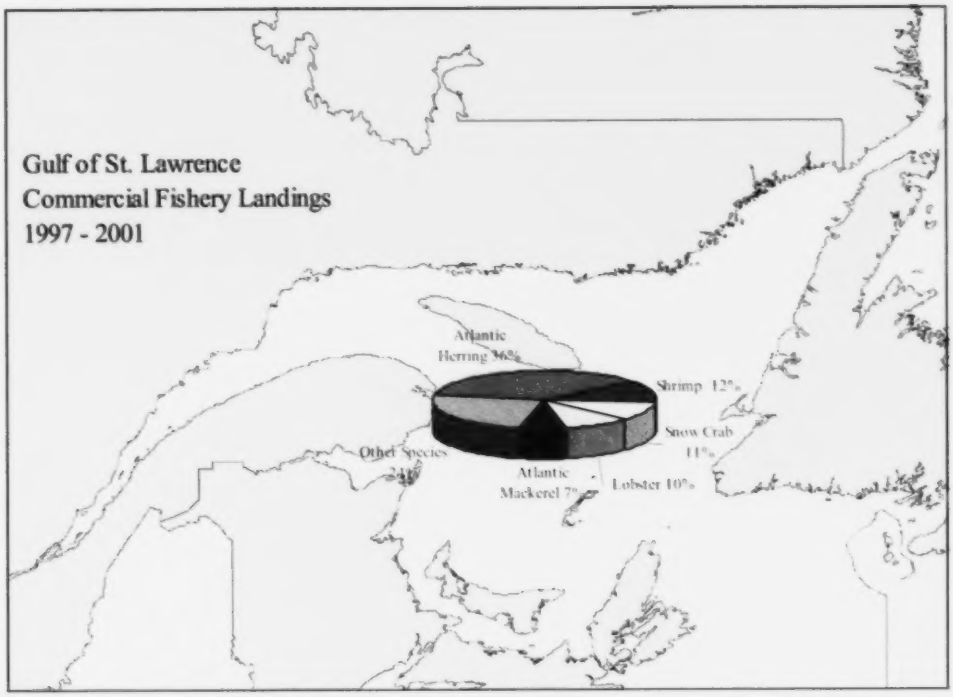


Figure 4-2 Percentage distribution of average annual commercial fishery landings in the Gulf of St. Lawrence, 1997-2001.

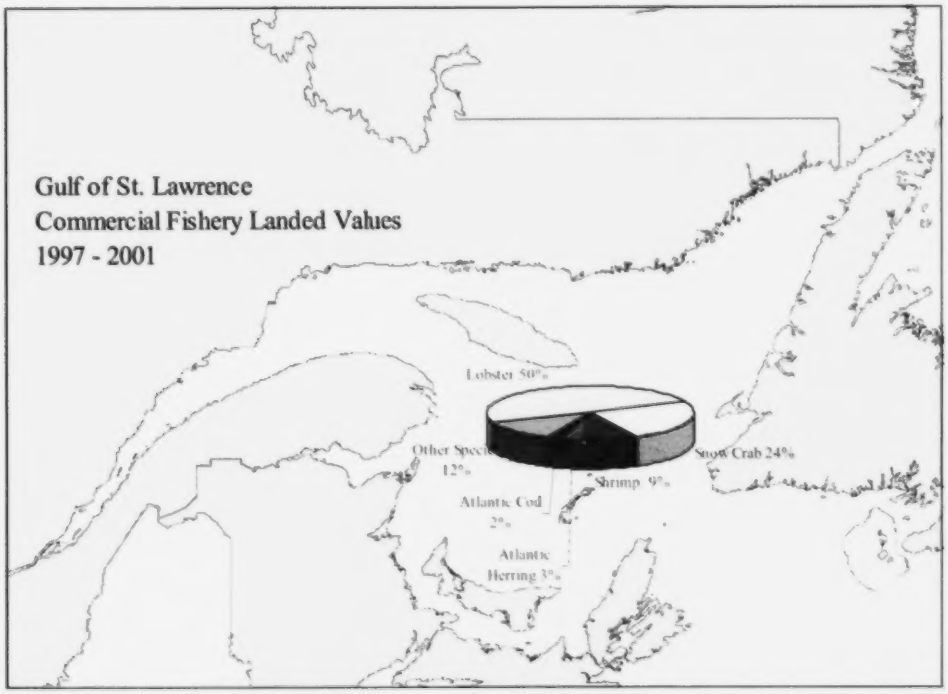


Figure 4-3 Percentage distribution of average annual commercial fishery landed values in the Gulf of St. Lawrence, 1997-2001.

The Newfoundland and Labrador portion of the Gulf of St. Lawrence accounted for approximately 19% (40,796t) of commercial landings in 1997-2001 and 9% ($42 million) of the landed value.

Herring contributed the single highest percentage of the landings (Fig. 4-4) while shrimp was the most highly valued (Fig. 4-5).

Quebec accounted for 21% (46,886t) of the landings and 26% ($121 million) of the landed value. Shellfish landings dominated the fishery in this region, accounting for more than 50% of total landings (Fig. 4-4) and 90% of the total value (Fig. 4-5). Shrimp contributed the single highest percentage of landings in Quebec, but snow crab was the most highly valued.

New Brunswick, Nova Scotia, and Prince Edward Island accounted for 60% (135,387t) of total commercial landings in 1997-2001 and 65% ($305 million) of the landed value. Herring, lobster, snow crab, mackerel, and Irish moss dominated the landings (Fig. 4-4) while lobster, snow crab, herring, oysters and shrimp were the most highly valued (Fig. 4-5). Herring contributed the single highest percentage of the landings while lobster was the most highly valued.

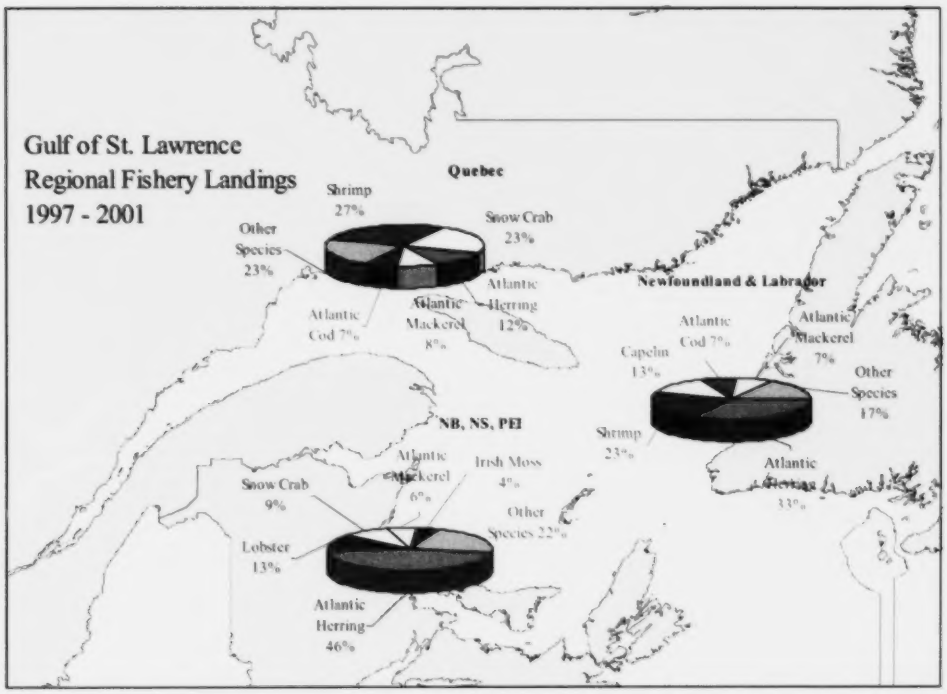


Figure 4-4 Percentage distribution of regional average annual commercial fishery landings, 1997-2001.

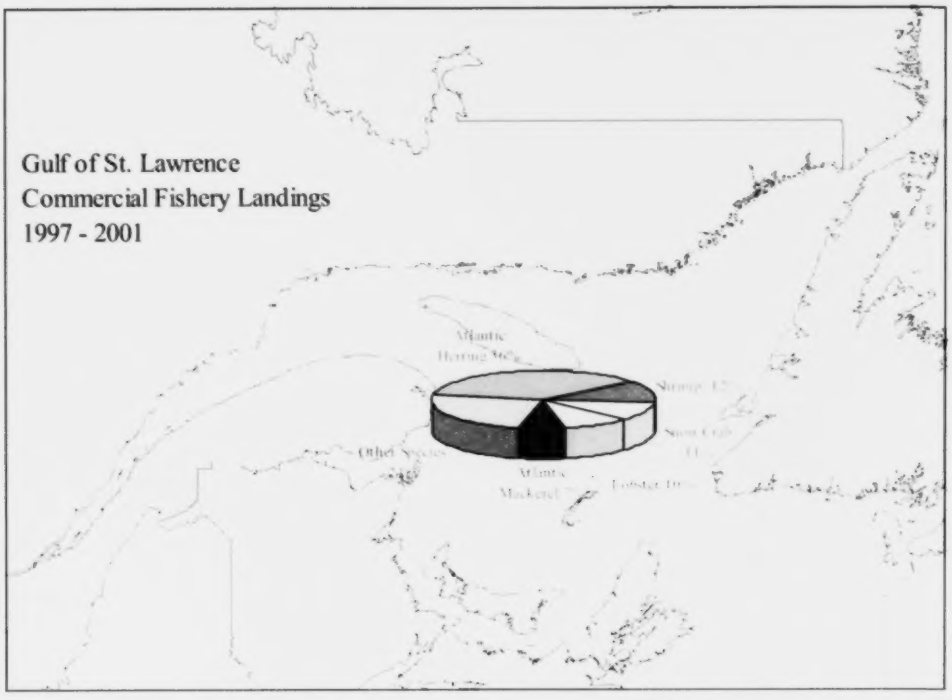
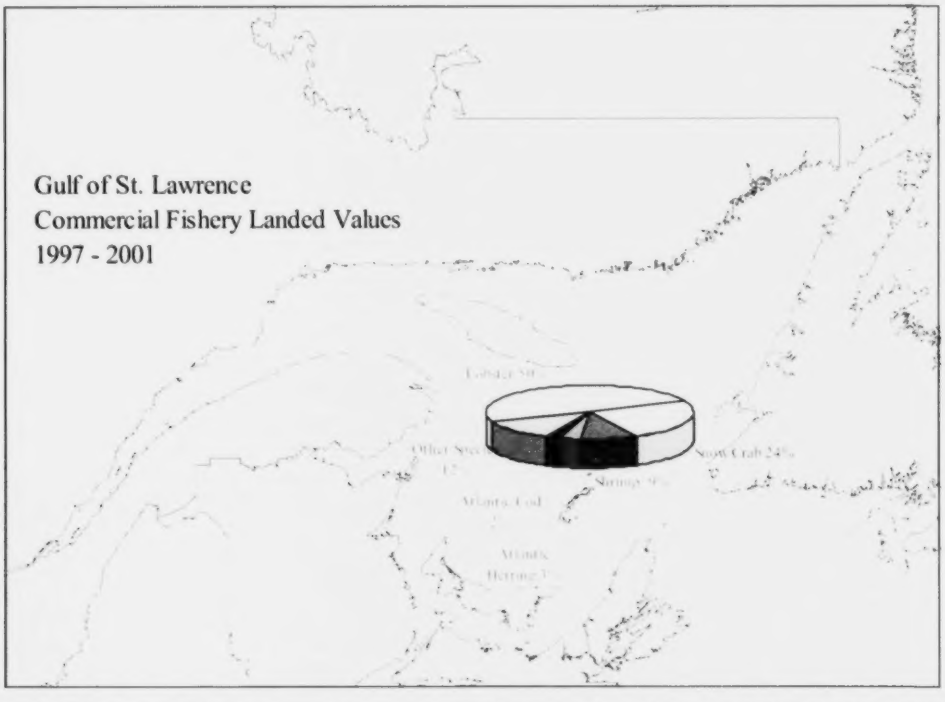


Figure 4-2 Percentage distribution of average annual commercial fishery landings in the Gulf of St. Lawrence, 1997-2001.



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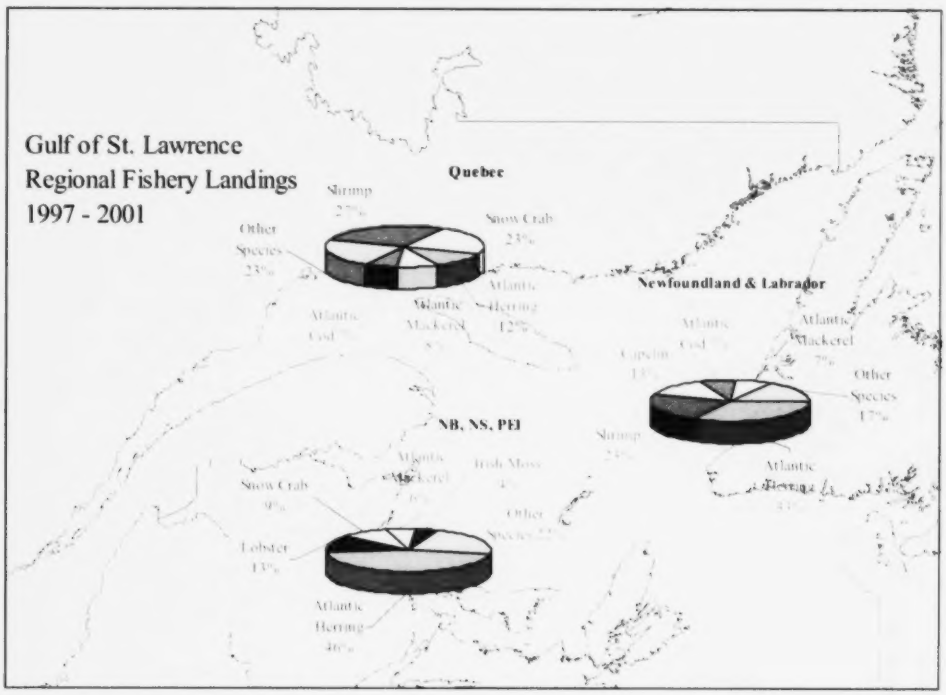

Figure 4-4 Percentage distribution of regional average annual commercial fishery landings, 1997-2001.

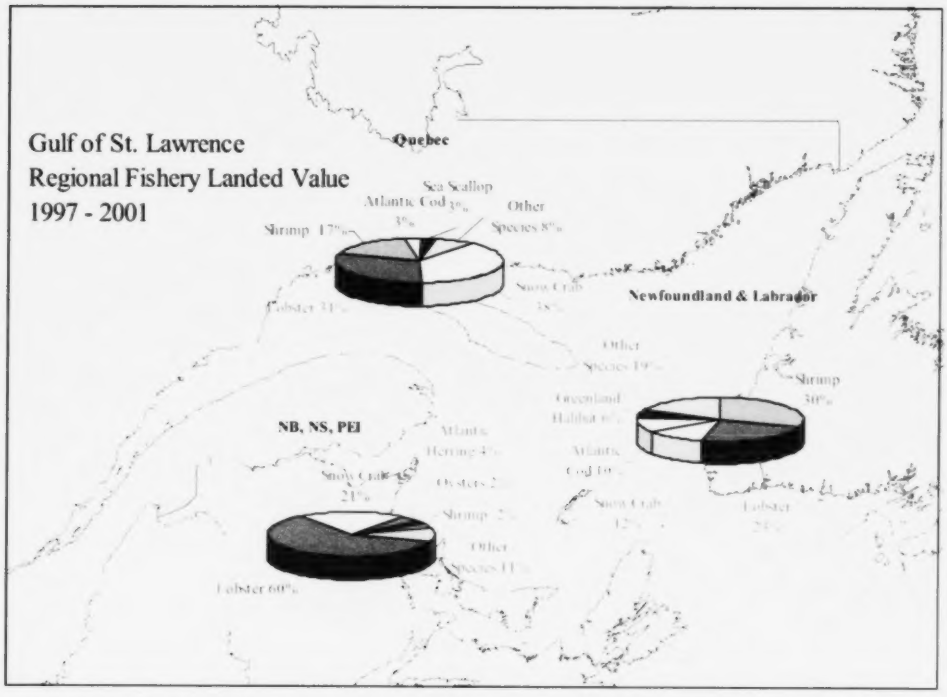

Figure 4-5 Percentage distribution of regional average annual commercial fishery landed values, 1997-2001.

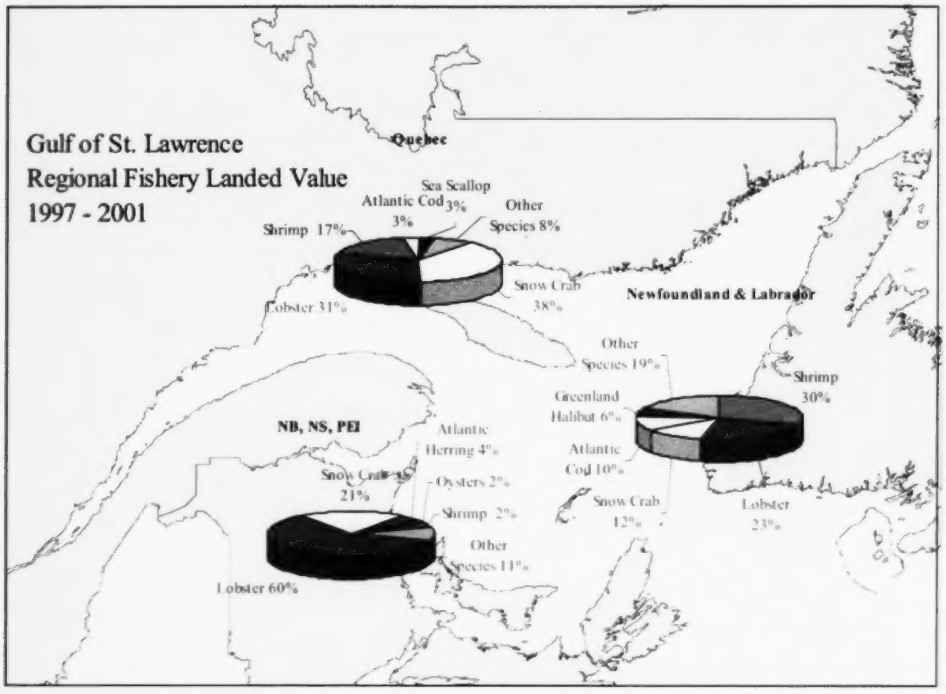

Figure 4-5 Percentage distribution of regional average annual commercial fishery landed values, 1997-2001.

Groundfish: Groundfish species (Table 4-1) have historically been the most heavily exploited in the Gulf of St. Lawrence. In 1997-2001, total landings for all groundfish averaged 17,490t with landings of Atlantic cod (DFO 2003*a*), Greenland halibut (DFO 2002*a*) and American plaice (DFO 2002*b*) being the highest (Table 4-1). In comparison, during the mid-1980's annual Atlantic cod (DFO 2002*c*) landings alone in the Gulf of St. Lawrence exceeded 160,000t and redfish (DFO 2000*b*) exceeded 70,000t. In 1990-1991, landings had declined to 68,000t for cod and 40,000t for redfish, but together they still represented 84% of total groundfish landings. The commercial cod fishery was placed under moratorium from 1992-1996; and again in 2003, but has been reopened to a limited fishery since 2004.

Total annual groundfish landings increased somewhat during 1997-2001 and were the highest in 1999 at approximately 20,000t (Fig. 4-6). The landed value of groundfish in 1999 was approximately $30 million (Fig. 4-6).

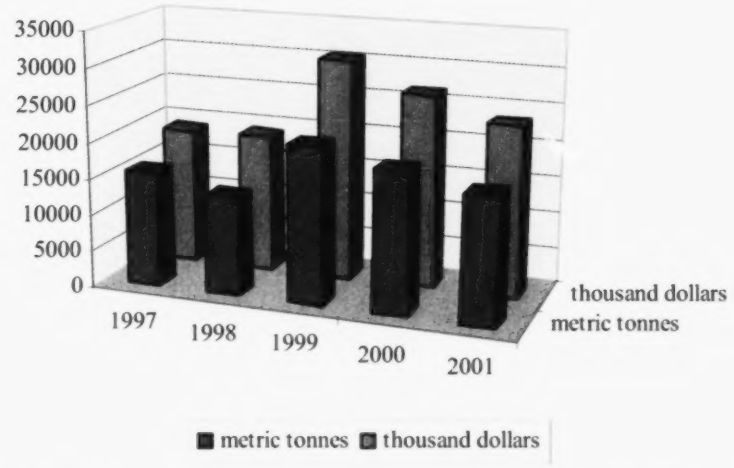

Figure 4-6 Groundfish commercial fishery landings (metric tonnes) and landed value ($,000) for the Gulf of St. Lawrence, 1997-2001.

Landings were similar among the three major regions of the Gulf of St. Lawrence in 1997-2001 (Fig. 4-7). Most of the major groundfish species present in the Gulf of St. Lawrence are commercially harvested. However, some species such as Atlantic halibut (DFO 2002*d*), Greenland halibut, winter flounder (DFO 2002*e*), witch flounder (DFO 2002*f*) and yellowtail flounder (DFO 2002*g*) have experienced declines in recent years and harvests have been under management restrictions in an effort to conserve stocks. Commercial groundfish restrictions include monthly quota allocations, shortened fishing seasons, gear restrictions, and by-catch limitations for species not directly targeted. Vessels are generally restricted to gillnets and longlines.

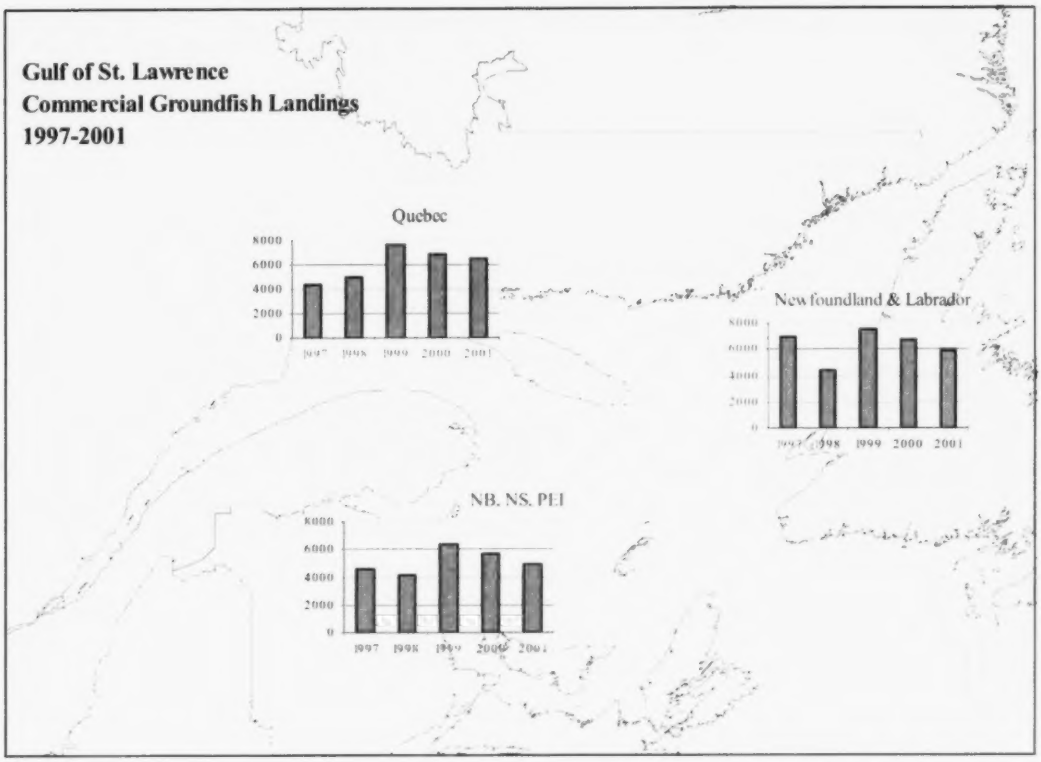

Figure 4-7 Groundfish commercial fishery landings (metric tonnes) in major regions of the Gulf of St. Lawrence, 1997-2001.

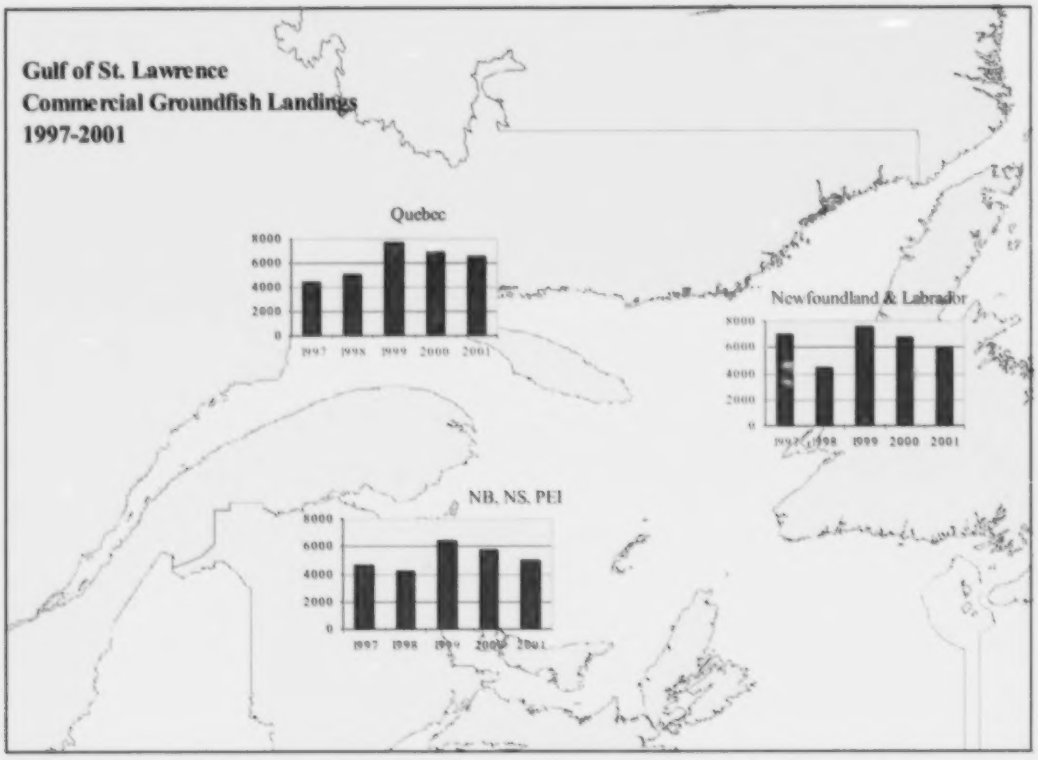

Figure 4-7 Groundfish commercial fishery landings (metric tonnes) in major regions of the Gulf of St. Lawrence, 1997-2001.

Table 4-1 Groundfish commercial fishery landings and landed values by species in the Gulf of St. Lawrence 1997-2001.

Common Name[4]	Scientific Name	Occurrence[5]	Fishing Activity (1997-2001)		
			Gear	Landings (t)	Value ($,000)
American plaice	*Hippoglossoides platessoides*	Occurs throughout the GSL; most abundant in 4Tfg; depths (73-274m)	Seine (4T), Gillnet (4R)	1650	1511
Atlantic cod	*Gadus morhua*	Northern GSL (4RS,3Pn): spawning (4Rcd); overwinter (3Pn); Southern GSL (4TVN): spawning (4Tln; 4Tf); overwinter (4VN; 4VS)	Gillnet;,longline; handline	8493	10946
Atlantic Halibut	*Hippoglossus hippoglossus*	Esquiman, Laurentian and Anticosti Channels (depths 200m +); 4Tfg; 4R (depths <100m)	Longline	258	1459
Atlantic Wolfish/ Catfish	*Anarhichas lupus*	Slopes of the Esquiman, Laurentian and Anticosti Channels; off eastern PEI and Chaleur Bay; depths (50-150m)	longline (by-catch)	60	31
Greenland Halibut	*Reinhardtius hippoglossoides*	Esquiman, Laurentian and Anticosti Channels (depths 130-500m)	Gillnet	3766	5180
Grenadier	*Nezumia bairdi*	Esquiman, Laurentian and Anticosti Channels; depths (183-732m)	gillnet (by-catch)	7	3
Haddock	*Melanogrammus aeglefinus*	Northern GSL (4R,3Pn); Southern GSL (4TVW)	gillnet (by-catch)	2	2
Hake	*Urophycis tenuis*	Northumberland Strait (4Th); St. Georges Bay, NS (4Tg); Magdalen Islands (4Tf); Cape Breton Trough (4Tf)	Gillnet, longline (by-catch)	291	295
Lumpfish	*Cyclopterus lumpus*	Inshore waters throughout GSL with rocky/stony bottom; spawning (shallow waters during spring)	Gillnet	12	2
Lumpfish Roe	*Cyclopterus lumpus*	Inshore waters throughout GSL with rocky/stony bottom; spawning (shallow waters during spring)	Gillnet	406	1251
Monkfish	*Lophius americanus*	Esquiman, Laurentian and Anticosti Channels; depths (70-150m, 650+m)	Gillnet, longline (by-catch)	12	7
Pollock	*Pollachius virens*	Occurs in the southern GSL (minor by-catches recorded in southern GSL and 4Rcd)	Gillnet, longline (by-catch)	3	2
Redfish	*Sebastes fasciatus; S. marinus; S. mentella*	4RST (depths 350-700m); feeding in the upper portion of water column at night; overwinter 3Pn and 4VN	Otter trawl surveys	424	346
Rock cod				9	926
Skate	*Raja ocellata; R. radiate*	4RST (depths 18-900m +)	Gillnet, longline	141	43
Spiny Dogfish	*Squalus acanthias*	4ST (mid summer); overwinters and spawns offshore along the northeastern U.S.	Gillnet, longline	271	108
Window Pane/ Spotted Flounder	*Scophthalmus aquosus*	Occurs in shallow waters with sandy bottom; Magdalen Islands; Miramichi estuary; Malpeque Bay, PEI; Port au Port Bay, NL; St. George's Bay, NL	Gillnet	36	23
Winter flounder	*Pseudopleuronectes americanus*	Magdalen Islands; Chaleur Bay; Shediac Valley-Miramichi area; Northumberland Strait; St. Georges Bay, NS; from Sacred Bay, NL (4Ra) to St. George's Bay, NL (4Rd); depths (< 40m)	Gillnet	750	626
Witch Flounder/ Greysole	*Glyptocephalus cynoglossus*	St. Lawrence estuary; Cape Breton Trough; southern slope of the Laurentian Channel; St. George's Bay, NL; eastern slope of the Esquiman Channel	Seine, gillnet	515	673
Yellowtail flounder	*Limanda ferruginea*	Magdalen Islands; Chaleur Bay; Shediac-Miramichi area; Northumberland Strait; St. Georges Bay, NS; St. John Bay and St. George's Bay, NL; depths (37-91m)	Seine, otter trawl	388	237
Total of all groundfish species				**17490**	**23670**

4 Scott, W. B. and M. G. Scott. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219: 731 p.

5 DFO, Canadian Science Advisory Secretariat. Publications: Stock Status Reports http://www.mpo-dfo.gc.ca/csas/applications/Publications/publicationsIndex_e.asp

Pelagics: From 1997 to 2001, landings of pelagic species averaged 106,435t and were valued at over $30M (Table 4-2). The commercial salmon (DFO 2003*b*) fishery has been under a moratorium since 1992 due to declining stocks. Herring (DFO 2002*h*), mackerel (DFO 2002*i*) and capelin (DFO 2001*j*) are presently the most heavily exploited pelagic species, contributing 95% of the total landings (Table 4-2). From 1997 to 2001, herring, mackerel and capelin landings averaged 81,089t, 14,774t and 5,634t, respectively (Table 4-2). Capelin landings increased rapidly during the late 1970's from approximately 2,000t to 10,000t, in response to the Japanese market demand for roe-bearing capelin. During the mid-1990s, high concentrations of smaller size capelin nearly resulted in a complete closure of the fishery. Capelin landings reached approximately 9,600t in 1998 before declining steadily to less than 800t in 2001. Other pelagic species such as Atlantic silversides, Atlantic tomcod, bluefin tuna, gaspereau alewife and American eel are also important commercial species in recent years, especially in Nova Scotia and Prince Edward Island. Total annual pelagic landings were relatively stable from 1997 to 2001 around 100,000t (Fig. 4-8). Total landed value ranged from $20 million to $30 million (Fig.4-8).

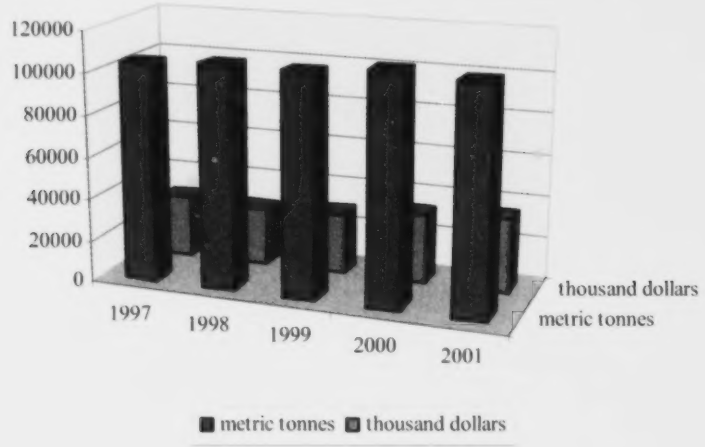

Figure 4-8 Pelagic commercial fishery landings (metric tonnes) and landed value ($,000) for the Gulf of St. Lawrence, 1997-2001.

Among the three major regions of the Gulf of St. Lawrence, landings of pelagic species were highest in New Brunswick, Nova Scotia and Prince Edward Island in 1997-2001 (Fig.4-9).

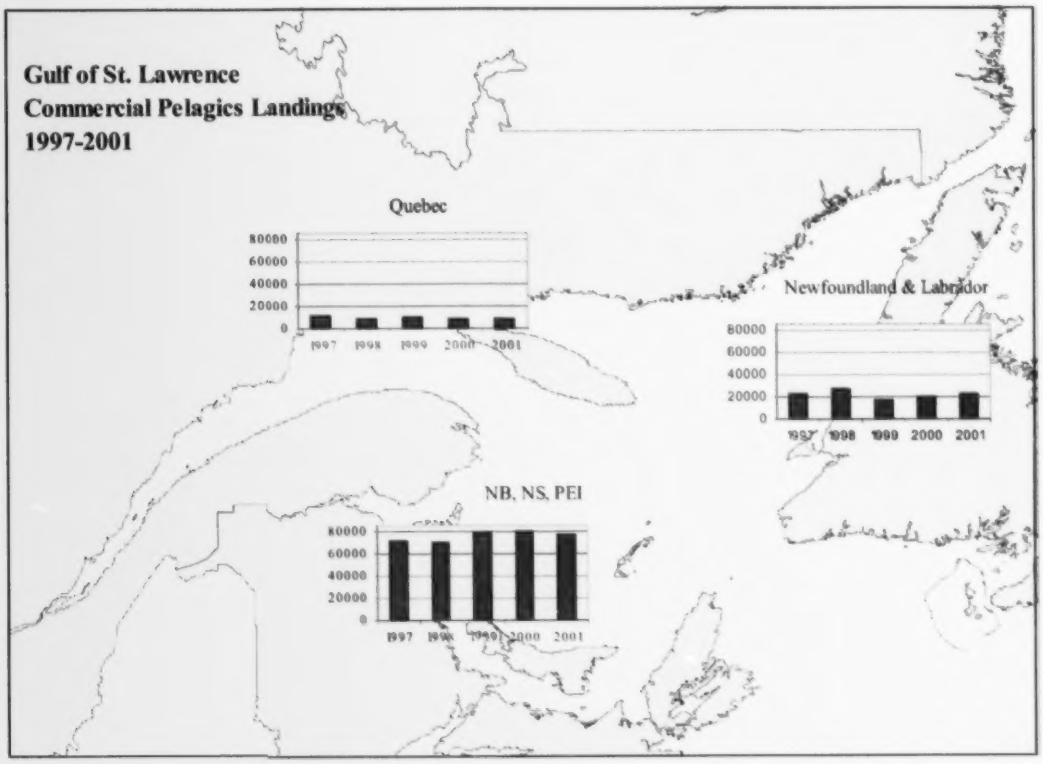

Figure 4-9 Pelagic commercial fishery landings (metric tonnes) for major regions in the Gulf of St. Lawrence, 1997-2001.

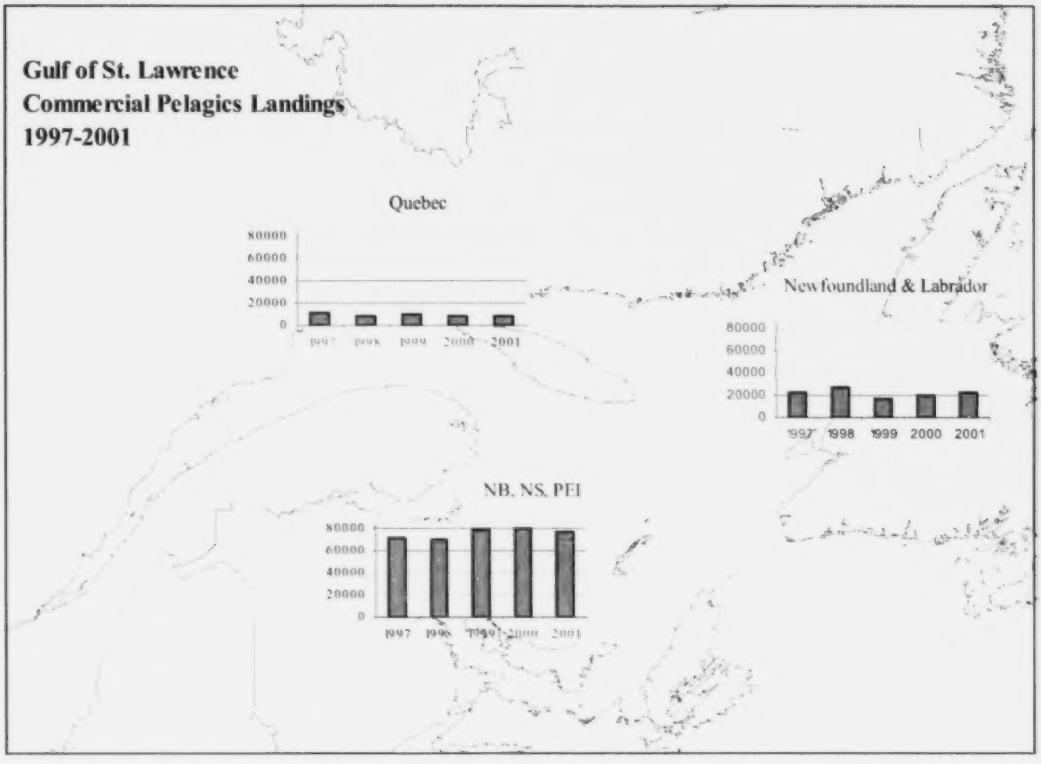

Figure 4-9 Pelagic commercial fishery landings (metric tonnes) for major regions in the Gulf of St. Lawrence, 1997-2001.

Table 4-2 Pelagic commercial fishery landings and landed values by species in the Gulf of St. Lawrence 1997-2001.

Common Name[6]	Scientific Name	Occurrence[7]	Fishing Activity (1997-2001)		
			Gear	Landings (t)	Value ($,000)
American Shad	*Alosa sapidissima*	St. Lawrence River and estuary; Major rivers and estuaries throughout Quebec and the Maritime provinces (especially the St. Lawrence; Miramichi; Shubenacadie Rivers); a few isolated areas along western NL; overwinter off northeastern U.S.	gillnets; trap nets; scoop nets; weirs	5	3
Atlantic Herring	*Clupea harengus harengus L.*	Spring spawning stock (spawning in shallow water); Fall spawning stock (spawning in deep offshore waters); 4R (St. George's Bay, Port au Port Bay; Bonne Bay; St. John Bay, off Pointe Riche, Strait of Belle Isle); 4T (Escuminac, NB and eastern Magdalen Islands areas; Chaleur Bay); 4S (major spawning populations along the Quebec North Shore)	seine (4R); gillnet (4S); seine, gillnet,trap (4T)	81089	16067
Atlantic Mackerel	*Scomber scombrus L.*	Spawning (Magdalen Islands); feeding (throughout major Bays along NL and NS Gulf shores); overwinter off the northeastern U.S.	seine; gillnet	14774	7531
Atlantic Silversides	*Menidia menidia*	4T (throughout inshore waters and estuaries)		395	250
Atlantic Sturgeon	*Acipenser oxyrhynchus*	4RST; spawning (major rivers along the Quebec North Shore and southern GSL; occurs occassionally along western NL)	gillnet; longline (by-catch)	1	1
Atlantic Tomcod	*Microgadus tomcod*	Occurs throughout major river systems in the GSL; 4R (Humber River; Grand and Little Codroy Rivers); 4T (Miramichi)		56	12
Bluefin Tuna	*Thunnus thynnus*	4T (Chaleur Bay; northern and eastern PEI; off Cape Breton)	angling; longline	152	3187
Capelin	*Mallotus villosus*	4RST; Esquiman Channel; St. Lawrence estuary	seine (4R); trap (4S - Quebec North Shore); weir (4ST - St. Lawrence Esturary)	5634	1264
Eel	*Anguilla rostrata*	Major rivers and estuaries throughout the GSL	weir (4S); eel trap, baited pots, weir, hoop net (4T); fyke net, baited pots (4R)	133	683
Gaspereau Alewife	*Alosa pseudoharengus*	Occurs throughout major river systems within the southern GSL (4T - Miramichi and Margaree Rivers) and southwestern NL (4Rd - Grand and Little Codroy Rivers)	trap net; weir	3305	858
Rainbow Smelt	*Osmerus motdax*	Occurs within most estuaries throughout the Quebec North Shore, eastern NB, NS and western NL; greatest abundance in the Miramichi River	bag net; box net	861	1028
Shark: Blue; Shortfin Mako; Porbeagle	*Prionace glauca; Isurus oxyrinchus; Lamna nasus*	Occurs throughout the GSL (during summer and fall)	gillnet; longlins (by-catch)	30	33
Total of all pelagic species				**106435**	**30918**

6 Scott, W. B. and M. G. Scott. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219: 731 p.

7 DFO, Canadian Science Advisory Secretariat. Publications: Stock Status Reports http://www.meds-sdmm.dfo-mpo.gc.ca/csas/applications/Publications/publicationIndex_e.asp

Shellfish: The downturn in groundfish and some pelagic fisheries has generated new interest in the shellfish industry, especially for shrimp (DFO 2002*k*) and snow crab (DFO 2002*l*). In 1997-2001, total shellfish landings averaged 92,479t and were valued at over $411M (Table 4-3). Shrimp and snow crab together contributed over 55% of all shellfish landings and 38% of the landed value (Table 4-3). Lobster (DFO 2002*m*) has the third highest shellfish landings (23%), but is the highest in terms of landed value at 55% of the total shellfish value. Icelandic scallops, sea scallops, rock crab, quahaugs, and oysters are also major contributors to the shellfish industry, while previously under-utilised species such as toad crab, sea urchin, whelk and various species of clams have created new opportunities for fish harvesters in the Gulf of St. Lawrence. Both landings and landed values increased during 1997 to 2001 with total values increasing the most (Fig. 4-10). Total shellfish landed values peaked in 2000 at over $450 million.

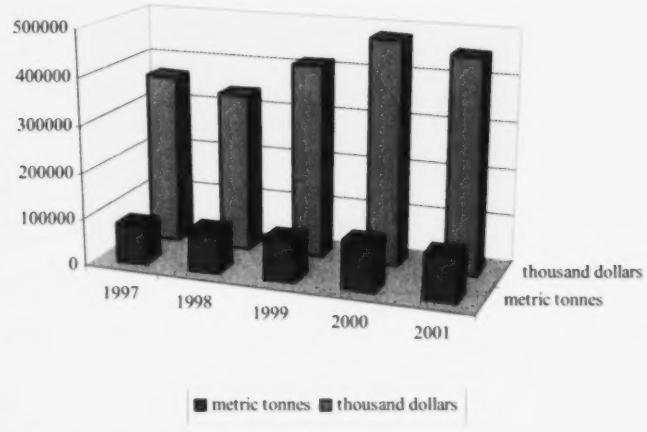

Figure 4-10 Shellfish commercial fishery landings (metric tonnes) and landed value ($,000) for the Gulf of St. Lawrence, 1997-2001.

Among the three regions of the Gulf of St. Lawrence, shellfish landings were highest in New Brunswick, Nova Scotia and Prince Edward Island and lowest in Newfoundland and Labrador in 1997-2001 (Fig. 4-11).

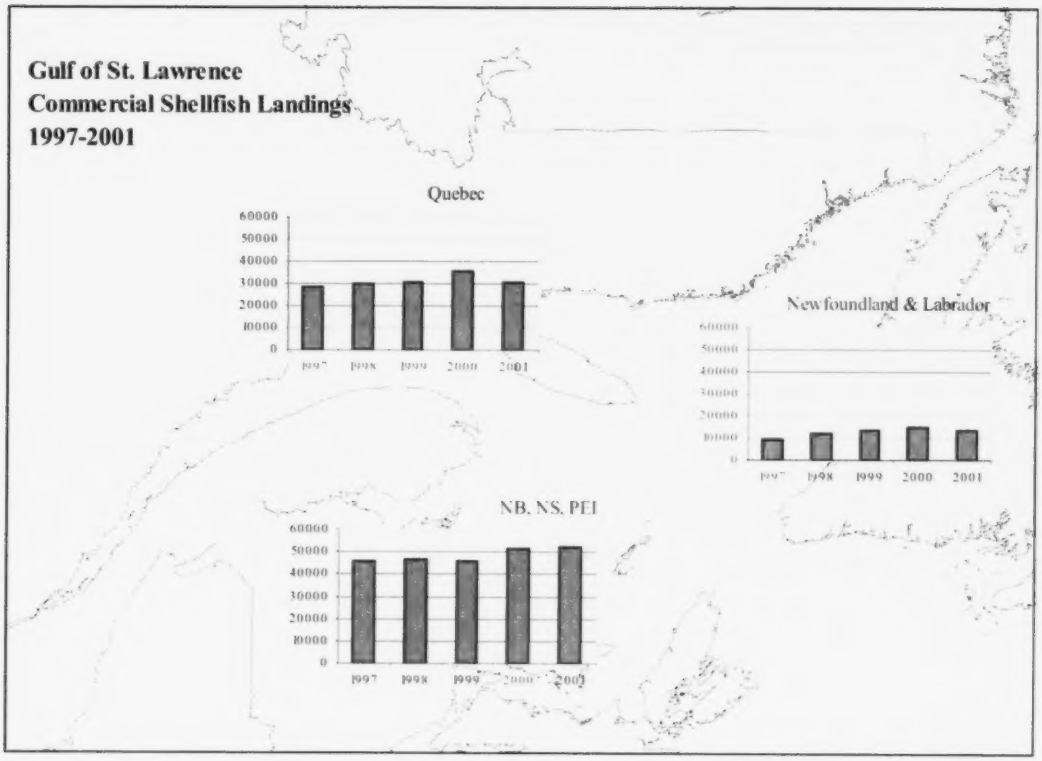

Figure 4-11 Shellfish commercial fishery landings (metric tonnes) for major regions of the Gulf of St. Lawrence, 1997-2001.

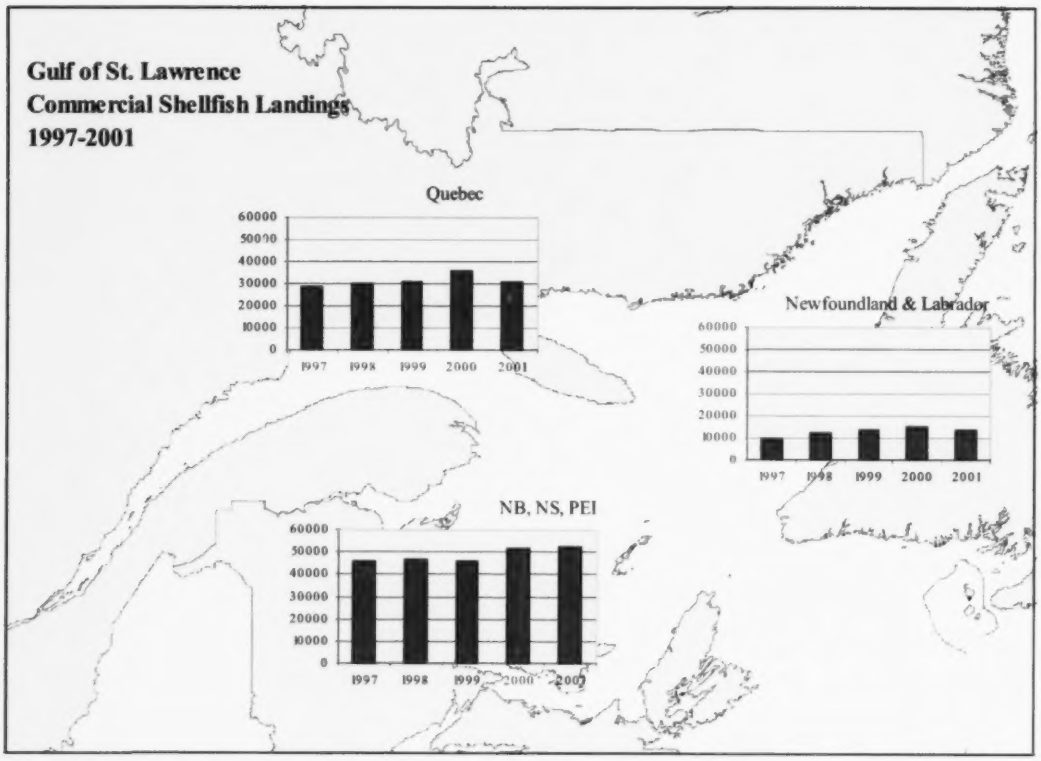

Figure 4-11 Shellfish commercial fishery landings (metric tonnes) for major regions of the Gulf of St. Lawrence, 1997-2001.

Table 4-3 Shellfish commercial fishery landings and landed values by species in the Gulf of St. Lawrence 1997-2001.

Common Name[8]	Scientific Name	Occurrence[9]	Fishing Activity (1997-2001)		
			Gear	Landings (t)	Value ($,000)
Bar Clam	*Spisula solidissima*	4T (most abundant along the northern and eastern coasts of PEI, the Northumberland Strait, and near Kouchibouguac and Cape Tormintine, NB); depths (1-25m)	hydraulic dredge	546	660
Green Sea Urchin	*Strongylocentrotus droebachiensis*	Occurs throughout the GSL; occupying hard and rocky substrate at depths of 1-200m; most abundant at depths of 1-10m	whelk pot; diving	67	104
Iceland Scallop	*Chlamys islandica*	4RS (commercial aggregates found in the Strait of Belle Isle, along the Quebec North Shore, around Anticosti Island and along the north shore of the Gaspe Peninsula)	scallop drag	1080	1683
Lobster	*Homarus americanus*	Localised populations occur throughout the GSL (depths 1-40m)	lobster pot	21502	227689
Northern Quahaug	*Mercinaria mercinaria*	4T (most abundant in the Miramichi and Cocagne areas of NB, the Hilborough area of PEI, and near Pugwash and Wallace, NS)	hand tool	892	2997
Oyster	*Crassostrea virginica*	4T (commercial aggregates found in Malpeque Bay, Summerside Harbour, and Hillborough and West Rivers, PEI; and bays and estuaries between Carquet Bay and Miramichi Bay, NB)	hand rake and tong	3190	7585
Razor Clam	*Ensis directus*	4T(intertidal zones of sand, mud and gravel)	hand tool	13	13
Rock Crab	*Cancer irroratus*	Occurs throughout the GSL (depths 1-40m); major target areas are from Chaleur Bay to western Cape Breton, around the Magdalen Islands, and along the north shore of the Gaspe Peninsula)	crab pot	6246	4021
Sea Scallop	*Placopecten magellanicus*	4ST (commercial aggregates found in Northumberland Strait, Chaleur Bay, Magdelan Islands, St. Georges' Bay, NL and Port au Port Bay, NL)	scallop drag	4607	8555
Shrimp	*Pandalus borealis*	Occurs along the slopes of the Esquiman, and Anticosti Channels, and St. Lawrence estuary (depths 150-350m)	Otter trawl	27432	40385
Snow Crab	*Chionoecetes opilio*	Occurs throughout the GSL on a variety of bottom substrates	conical trap; Japanese trap	24281	114167
Soft Shell Clam	*Mya arenaria*	4T (commercial aggregates found in the Tracadie, Miramichi, Richibouctou and Bouctouche areas of NB, and all along the eastern and southern coasts of PEI)	clam rake and shovel (NB); hydraulic dredge (PEI)	1060	2305
Squid	*Illex illecebrosus*	Occurs throughout the GSL (Sporadic migration patterns, changing from year to year)	handline	3	2
Stimpson's Surf Clam	*Mactromeris polynyma*	4ST (commercial aggregates found along the Quebec North Shore, east coast of the Magdalen Islands, northern PEI, the Gaspe coast, and west coast of Cape Breton Island)		251	163
Toad Crab	*Hyas. Sp*	Occurs throughout the GSL (depths 1-60m, but most common at depths of 35-50m)	crab pot	527	324
Waved Whelk	*Buccinum undatum*	4RS (depths 1-30m)	whelk pot	780	599
Total of all shellfish species				**92479**	**411251**

8 Scott, W. B. and Scott, M.G. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219: 731 p.

9 DFO. Canadian Science Advisory Secretariat. Publications: Stock Status Reports http://www.meds-sdmm.dfo-mpo.gc.ca/csas/applications/Publications/publicationIndex_e.asp

Marine Plants: Harvesting of marine plants is relatively new in the Gulf of St. Lawrence with activity concentrated mainly in Prince Edward Island. Species of interest include Irish moss (*Chrondrus crispus*) and wire weed (*Furcellaria lumbricalis)*, (DFO 2000*a*). High concentrations of wire weed exist along the western portion of Prince Edward Island near Miminegash and Tignish. Irish moss occurs throughout much of Atlantic Canada's inter-tidal zone. Marine plant landings averaged 13,337t in 1990-1991 and 6,666t in 1997-2001. Harvesting of marine plants is directly influenced by market demand and fluctuates from year to year. Annual harvests declined somewhat from 1997-2001 (Fig. 4-12).

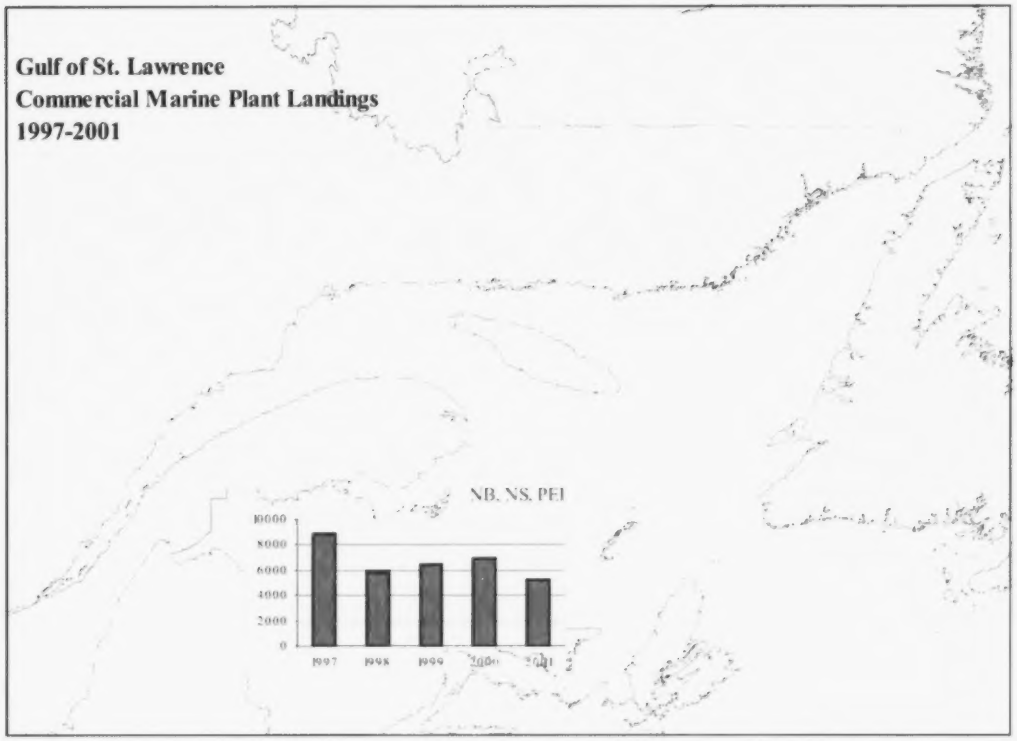

Figure 4-12 Marine plant commercial landings (metric tonnes) for major regions of the Gulf of St. Lawrence, 1997-2001.

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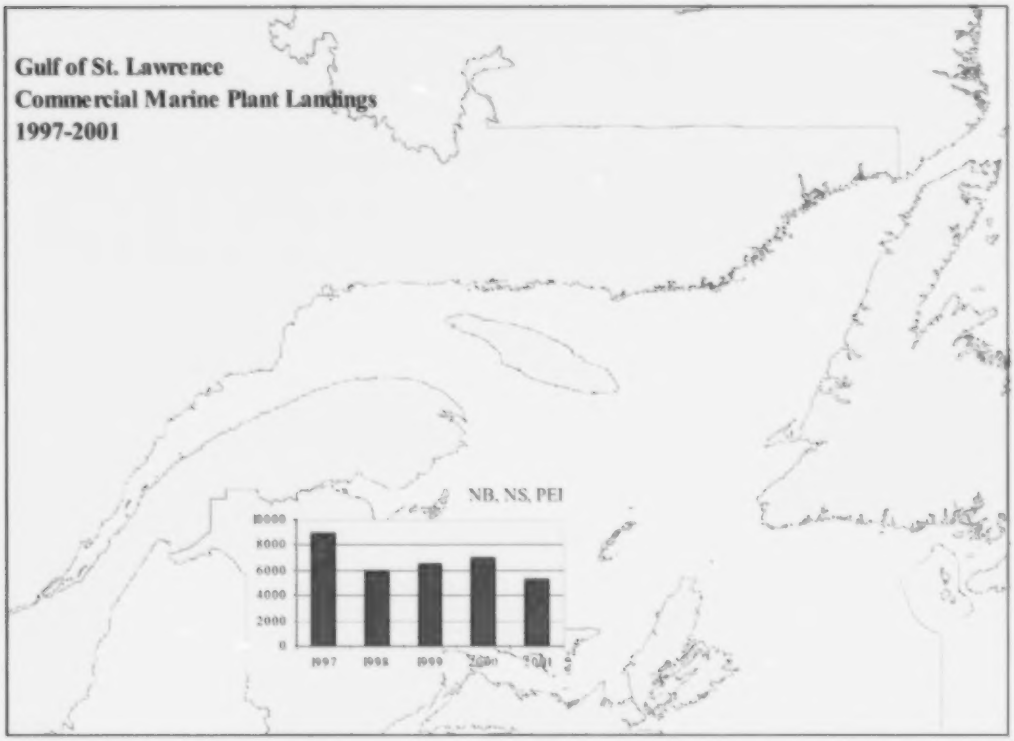

Figure 4-12 Marine plant commercial landings (metric tonnes) for major regions of the Gulf of St. Lawrence, 1997-2001.

4.2.3 Commercial Seal Hunt

The commercial seal hunt in Atlantic Canada dates back a couple of centuries. The industry grew throughout the 20th century, largely to meet the demand for fur. The estimated landed value (based on average prices paid to sealers) of harp seals (Atlantic Canada) in 2001 was $5.5 million. The value increased to $21 million in 2002 due to extremely favourable market conditions (DFO 2003*c*). The seal hunt provides many fish harvesters throughout Atlantic Canada with an alternative income especially since the downturn of the groundfish fisheries. In recent years, personal use sealing licences have been issued to residents adjacent to sealing areas in Newfoundland and Labrador (south of 53°N latitude), the Quebec North Shore, the Gaspé Peninsula and the Îles-de-la-Madeleine.

Six species of seals inhabit Canadian Atlantic waters, four of which are found in the Gulf of St. Lawrence: Harp seal (*Phoca groenlandica*); Hooded seal (*Cystophora cristata*); Grey seal (*Halichoerus grypus*); and Harbour seal (*Phoca vitualina*).

The replacement yield[10] is used as a benchmark for sustainable management of seal populations. In response to declining seal populations and landings during the 1960s, a number of restrictions were put in place including the establishment of a total allowable catch (TAC) on seal landings. A Royal Commission on Seals and Sealing, chaired by Judge Albert Malouf, implemented a new policy in 1987 in response to the European Economic Community (EEC) decision to stop the import of sealskins. This new policy provides much of the guidance for DFO's existing management approach on sealing.[11] Following the implementation of this policy, the seal hunt became a coastal activity engaged by people in rural and coastal communities that targeted mostly juveniles and older seals. Other measures adopted by the sealing industry and the Canadian government to ensure the healthy management and exploitation of this resource include the policy of distributing licenses for the seal hunt in eastern Canada, humane hunting practices (Article 8 of the Law on Marine Mammals) and the viable management strategy for oceans (National Round Table on the Environment and Economy, 1998).[12] Upon implementing the Atlantic Seal Hunt 2003 – 2005 Management Plan, DFO has adopted an Objective-Based Fisheries Management (OBFM) approach for harp seals. This management model uses control rules and reference points to establish management measures for a fishery.[13] This approach has not yet been applied to other seal species due to lack of available data regarding these species.

The TAC for harp seals has increased continuously for Atlantic Canada since being introduced in the 1960s. Yet more harp seals are recruited into the populations than are harvested and, except for 1998, the number of harp seals harvested has not surpassed the prescribed quota (Table 4-4). There is no hunt for hooded seals in the Gulf of St. Lawrence and the harvesting of grey seals is minimal. The hunt for grey seals is limited to a traditional hunt on a small scale in a zone off Îles-de-la-Madeleine. There is no commercial hunt for harbour seals in the Gulf of St. Lawrence. Table 4-5 highlights the TAC implemented under the Atlantic Seal Hunt 2003 – 2005 Management Plan.

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10 The replacement yield is the number of animals that can be taken in a given year without reducing the total population of the next year.

11 A Royal Commission on Seals and Sealing implemented a new policy in 1987 prohibiting the use of large ships during the hunt; hunting of whitecoats and bluebacks (harp and hooded seal pups respectively); and the use of nets except for traditional hunts North of the 53rd parallel.

12 Lauzon, M. and Dallaire, P. 2002. Portrait of the Commercial Seal Hunt in the Gulf of St. Lawrence. (unpublished)

13 Reference points are pre-established population levels that trigger specific management actions when they are reached. Control rules are specific, pre-established actions that are triggered at certain reference points. Control rules include measures such as a lower TAC, changes to season length and area closures. Reference points have been set at 70%, 50% and 30% of 5.5 million (the maximum observed size of the harp seal herd) for the duration of the management plan.

Table 4-4 Annual TAC and landings for the commercial harp seal hunt in Atlantic Canada, 1972-2002.

YEAR	1972-82	1983-95	1996	1997	1998	1999	2000	2001	2002
TAC (000's)	175	186	250	275	275	275	275	275	350
Landings (000's)	165[1]	52[1]	242	264	282	244	92	226	312

Source: DFO 2003.

Table 4-5 Total allowable catch implemented under the Atlantic Seal Hunt 2003 – 2005 Management Plan.

Species	Total Allowable Catch (TAC)
Harp seal	975,000 over three years with an annual TAC up to 350,000 in any two years provided that the combined TAC over three years is maintained by a reduction in the TAC in the other years.
Hooded Seal	The TAC remains at 10,000 per year. As in previous years, there will be no hunt of hooded seals in the Gulf of St. Lawrence.
Grey Seal	A small harvest of grey seals is allowed in areas other than Sable Island.
Harbour Seal	There are no TACs or allocations set on these species. Licenses and permits are used to control any commercial harvest of these seals.

Source: DFO 2003.

The Gulf of St. Lawrence is divided into 17 commercial sealing zones. Zones 10 – 12 fall under the jurisdiction of the Newfoundland and Labrador Region; Zones 13 – 20, Quebec Region; and Zones 21 – 26, Gulf Region (Figure 4-13).

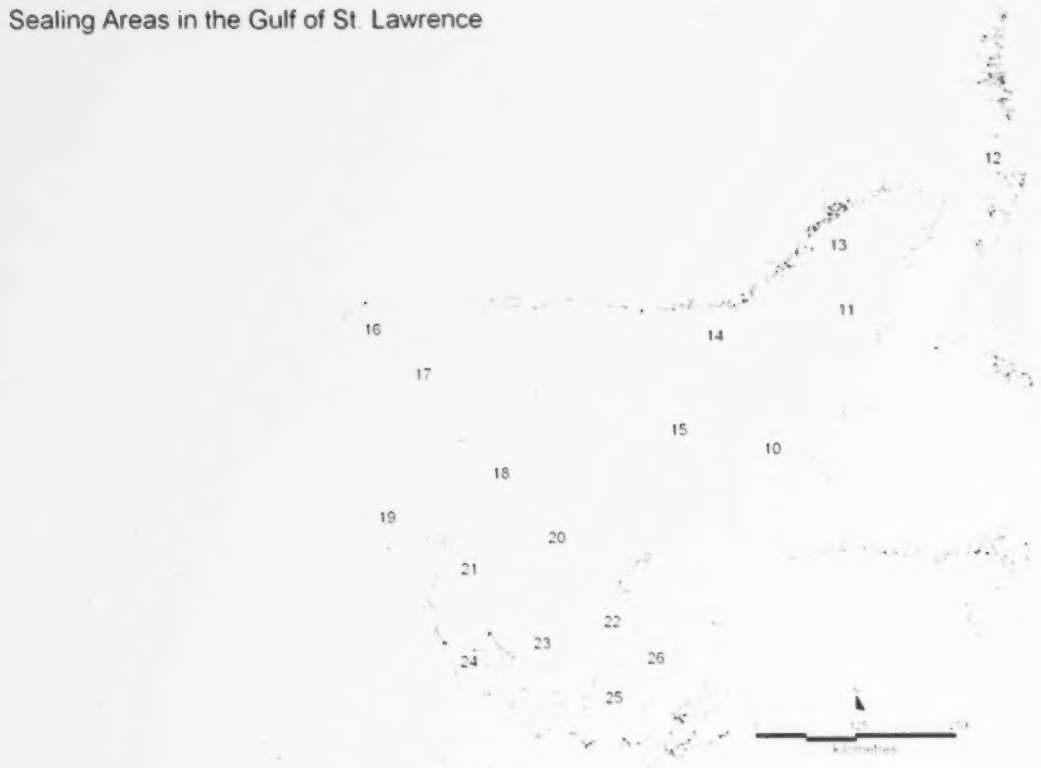

Figure 4-13 Commercial sealing zones in the Gulf of St. Lawrence and estuary.

DFO issues three classes of seal licenses: Professional Hunter License; Assistant Hunter License and Personal Use License. In 2002, DFO issued 14,435 licenses. As in previous years, no licenses were issued to the province of New Brunswick. Residents of Labrador north of 53°N latitude do not require a licence to hunt seals for subsistence purposes. Since 1995, personal use sealing licences have been issued to residents adjacent to sealing areas in Newfoundland and Labrador (south of 53°N latitude), the Quebec North Shore, the Gaspé Peninsula and the Îles-de-la-Madeleine. These are areas hard-hit by the groundfish fishery closures. This type of licence allows the holder to take up to six seals for personal consumption. Table 4-6 provides a breakdown of licenses issued during the 2002 commercial seal hunt.

Table 4-6 Number of seal licenses issued in Atlantic Canada in 2002.

Province	Professional	Assistant	Personal Use	Total	# of vessels > 35'
Newfoundland and Labrador	7,200	3,788	1,235	12,223	705
Quebec	1,455	194	526	2,175	60
Nova Scotia	1	20		21	
Prince Edward Island	12	4		16	8
Total	8,668	4,006	1,761	14,435	773

Source: DFO 2002.

The majority of sealing occurs between early March and May, beginning around the second week in March off the Îles-de-la-Madeleine, and about the second week in April off the west coast of

Newfoundland and Labrador. The timing of hunt activities in the Gulf of St. Lawrence depends largely on the movement of ice floes on which seals are located. The peak commercial hunt in the Gulf of St. Lawrence is in March, although sealing does occur along the Quebec North Shore in January and February. In certain circumstances, DFO has authority to alter the season closure through a modifying order. Table 4-7 provides an overview of season openings for the commercial seal hunt in the Gulf of St. Lawrence.

Table 4-7 Season start and end dates for the commercial seal hunt in the Gulf of St. Lawrence.

Species	Season Start and End Dates	Hunting Areas
Harp seal	November 15 to May 15	10 to 17, 20, 22 and 26
	Closed	18, 19, 21, 23, 24 and 25
Hooded seal	November 15 to May 15	12
	Closed	10, 11, 13 to 26
Grey seal	January 1 to February 28	20
	Controlled by condition of license	10 to 19, 21 to 26
Harbour seal	Closed	10 to 26

Source: DFO 2003.

Seal landings in the Gulf of St. Lawrence vary from year to year as a result of accessibility to the herd which is greatly influenced by seasonal ice coverage. Seal landings between 1992 and 2001 varied from a minimum of 4,915 in 1993 to a maximum of 143,094 in 2001 (Figure 4-14). Gulf of St. Lawrence landings account for an average of 30% of total annual landings (Gulf of St. Lawrence and Front combined). Harp seals account for the majority of landings in the Gulf of St. Lawrence. An estimated 312,000 harp seals were landed in the Gulf of St. Lawrence and the front in 2002. From 1992 to 2001, Newfoundland and Labrador accounted for 41% to 87% of total harp seal landings in the Gulf of St. Lawrence, while the Îles-de-la-Madeleine and Quebec North Shore accounted for an average of 25% and 3% respectively, and Nova Scotia and Prince Edward Island 2%. Although abundant on the front, hooded seal landings are largely absent (min 0; max 42 between 1992 and 2001) in the Gulf of St. Lawrence. Landings of grey seals are minimal (min 0; max 364 between 1992 and 2001) in the Gulf of St. Lawrence with harvesting concentrated in the southern Gulf of St. Lawrence.[12]

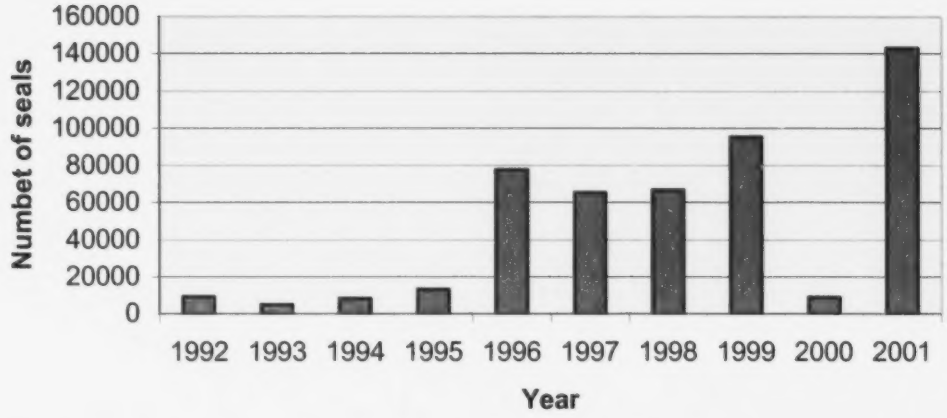

Figure 4-14 Seal landings (all species) in the Gulf of St. Lawrence, 1991–2001. Preliminary data courtesy of DFO (2002).

4.2.4 Summary

Total commercial fishery landings in the Gulf of St. Lawrence declined in recent years. Excluding seals, annual commercial landings in the Gulf of St. Lawrence averaged 223,069t in 1997-2001, 32% lower than five years earlier in 1990-1991, immediately prior to any commercial groundfish fishery moratorium (Table 4-8). In contrast, landed value has increased. Total landed value averaged over $467 million in 1997-2001 compared to $295 million in 1990-1991, a 58% increase.

Table 4-8 Average annual landings and landed values of commercial fisheries species (except seals) within the Gulf of St. Lawrence 1997-2001 and 1991-1990.

	1997-2001		1990-1991	
Region	**Landings (t)**	**Landed Value ($)**	**Landings (t)**	**Landed Value ($)**
NL	40,796	41,765,000	77,513	40,340,000
Quebec	46,886	120,751,000	74,086	80,086,000
NB, NS, PEI	135,387	304,589,000	178,521	174,991,000
TOTAL	223,069	467,105,000	330,120	295,417,000

This change is attributed to a combination of low abundance of some species, moratoria, management restrictions and a shift to more highly valued species or previously underutilized species. Groundfish landings contributed only 8.0% of commercial landings in 1997-2001 compared to 38.7% in 1990-1991 (Table 4-9). In the same period, pelagic landings increased by 39% and shellfish landings increased by 80%. This increase in shellfish and to a lesser extent in pelagic landings not only reflects the reduction in direct groundfish effort, but also increased fishing effort in some areas for previously underutilized shellfish such as shrimp, snow crab, rock crab, toad crab, quahaugs, oysters, whelk and several clam species. The degree to which fluctuating market prices affected landed values is unknown.

Table 4-9 Percentage of total landings and landed values by species category for pre- and post - moratorium fisheries in the Gulf of St. Lawrence.

	1997-2001		1990-1991	
Species Category	**Landings (t)**	**Landed Value ($)**	**Landings (t)**	**Landed Value ($)**
Groundfish	8.0%	5.1%	38.7%	24.1%
Pelagic	48%	6.6%	34.5%	8.2%
Shellfish	41%	88%	22.7%	66.6%
Marine Plants	3.0%	0.3%	4.1%	1.1%
TOTAL	100	100	100	100

All three of the DFO regions (Newfoundland and Labrador, Gulf, and Quebec) experienced similar changes to the Gulf of St. Lawrence as a whole. In Newfoundland and Labrador, and Quebec (especially the Quebec North Shore) where there was historically more dependence on cod and redfish (84% of groundfish landings prior to 1992), the change was attributable to the moratorium on these species. Whereas in New Brunswick, Nova Scotia and Prince Edward Island, where the fishery has traditionally been more diverse, especially among shellfish, the change was more reflective of an increase in shrimp and snow crab landings plus a number of previously underutilized shellfish species.

The significance of the commercial fishery to coastal communities along the Gulf of St. Lawrence cannot be overstated. Most of these communities evolved from the commercial fishing industry and many still are one-industry communities, supported by current fisheries. The annual estimated value of commercial fish landings in recent years is approximately $500 million, excluding seals. Taking into account the export value of fish, secondary processing and other fishery related services, it would be safe to say the commercial fishing industry in the Gulf of St. Lawrence is a billon dollar industry. The collapse of the Atlantic cod fishery was a major turning point in the industry. Tens of thousands of jobs were loss causing a flurry of out migration from many coastal communities. It was a period of industry restructuring including improved management practices, fewer processing plants and the development of new fisheries targeting underutilized species such as shrimp and crab. While recent landings of commercial fish species have declined about 30% from pre-moratorium levels, the value of landings has increased approximately 60% over the same period. A greater demand for product, a competitive market, and the increased cost of fishing and processing practices have all supported increases in the value of seafood products. Shellfish species such as lobster, snow crab and shrimp account for more than 40% of landings and 88% of the landed value in recent years.

The commercial fishery is a complex and controversial subject consisting of significant socio-economic and ecological factors. Many are concerned that the collapse of the Atlantic cod stocks in the early 1990s may very well occur again with other species. The Gulf of St. Lawrence is a marine ecosystem; a food chain that consists of numerous marine species and a complex habitat that supports the survival of these species. Little is known what affect the collapse of one or more species has on the entire ecosystem. What effect does the degradation of species at the bottom of the food chain (shrimp, capelin) have on other species that feed on them? To what extent does global warming effect the behaviour or survival of marine species? What effect does invasive species have on current fish stocks and what can be done to prevent the introduction of invasive species? Do current management practices support a healthy ecosystem? What lessons have been learned from past fishing practices and the collapse of the Atlantic cod stocks, and how can these lessons be used to create a ballance between sustainable management of this marine ecosystem and the socio-economic demands of coastal communities that depend on the commercial fisheries?

As with other industries, the commercial seal hunt is driven by market demand, but is also affected by changing ice conditions in any given year, and by scrutiny from those who oppose the hunt. Although the movement of ice floes and ice conditions often determine the degree of effort in any given area, the majority of the seal hunt occurs on the front (north and east coasts of the island of Newfoundland and off southern Labrador). In 2002, almost all hunting activity took place in the front. Ice conditions in the Gulf of St. Lawrence were not conducive to fishing as most of the ice melted ahead of time, also resulting in increased natural mortality of seal pups (perhaps as much as five times the norm). About 75% of the harp seal pups are born in the front, where ice conditions are generally normal.

4.2.5 Information Gaps

The commercial fishing industry has experienced significant changes during the past 30 years. It would be important to capture some of these changes and trends within the industry. Unfortunately, at time of writing, landing and value data for this period was not available for all three regions. Furthermore, the availability of catch data vs. landing data would provide significant information regarding fishing effort including general location, types of gear used, and time of year. Similarly, data showing the distribution of fishing licenses may also provide some light on the level of involvement within the industry and changes over time. While it would seem appropriate to discuss fish processing in this section, it was decided to discuss this activity under the section for land-based activities.

4.3 AQUACULTURE

4.3.1 Background

The aquaculture industry in the Gulf of St. Lawrence is strong and vibrant and has become a significant contributor to a diverse economy. The industry, which was almost non-existent a decade ago, has experienced relatively rapid growth due to technological advances and a growing demand for seafood. The depletion of a growing number of commercially important species continues to stimulate the industry. The future potential of the industry is considered to be good, but requires large investment in research and development in terms of technology, but also in terms of understanding and controlling potential environmental impacts and learning to co-exist with other human uses of the marine environment.

The industry is regulated by both federal and provincial legislation including the federal Fisheries Act, Fish Inspection Act, Navigable Waters Protection Act, Canadian Environmental Assessment Act and various provincial Aquaculture acts (see Appendices I and II). These pieces of legislation require that a lease or licence be acquired to operate any aquaculture facility. With the exception of Prince Edward Island, where Fisheries and Oceans Canada (Aquaculture Division) retains authority, the other Atlantic provinces bordering the Gulf of St. Lawrence are responsible for their own aquaculture leasing and licensing process. In the late 1980s, the Government of Canada signed Memorandums of Understanding (MOU) with the four Atlantic provinces and Quebec, whereby the lead authority (except for PEI) for aquaculture development was transferred to the provinces. Lead authorities are responsible for administering their respective legislation for aquaculture development and overseeing the licensing process including approvals from other provincial and federal agencies (Cook and Simpson 1995).

Due to the multi-jurisdictional setting of the aquaculture industry, retrieving information was often difficult and time consuming. The availability of information on the type and location of aquaculture operations, as well as landings and values were not consistent among the five provinces. This limited the amount of detail that could be presented in this document. Much of the data for Newfoundland and Labrador (Government of Newfoundland and Labrador 2004*a*; 2004*b*), Quebec (Gouvernement du Québec 2001*a*; 2004*b*) and Nova Scotia (Government of Nova Scotia 2004*a*; 2004*b*) were taken from available online databases. An effort to establish an effective communication link with all jurisdictions is necessary, as the availability of raw data is important to identify the current status and potential of the aquaculture industry in the Gulf of St. Lawrence.

In the Gulf of St. Lawrence, a number of government and non-government committees and associations have also been established to focus on strategic development and to set standard practice for the industry (Table 4-10).

Table 4-10 Aquaculture committees and associations in the five provinces bordering the Gulf of St. Lawrence.

Province	Aquaculture Committees and Associations
Newfoundland and Labrador	The Newfoundland Aquaculture Industry Association; Newfoundland Salmonid Growers Association
Quebec	Association des aquaculteurs du Québec ; Regroupement des mariculteurs du Québec
New Brunswick	Aquaculture Association of New Brunswick; New Brunswick Salmon Growers Association; New Brunswick Trout Farmers Association; Professional Shellfish Growers Association of New Brunswick; and New Brunswick Seafood Processors Association
Nova Scotia	Nova Scotia Aquaculture Development Committee; Regional Aquaculture Development Advisory Committees (RADAC); The Aquaculture Association of Nova Scotia
Prince Edward Island	PEI Shellfish Advisory Committee; PEI Aquaculture Committee; Sea Duck Aquaculture Working Group; Shellfish Classification Working Group; Prince Edward Island Aquaculture Alliance; Prince Edward Island Cultured Mussel Growers Association, the Island Oyster Growers Group Inc., PEI Finfish Association, and the Island Clam Growers Group

4.3.2 Aquaculture Activity

Approximately 1800 aquaculture sites are distributed throughout the Gulf of St. Lawrence, with 96% of sites concentrated along the coasts of Prince Edward Island, New Brunswick and Nova Scotia (Table 4-11; Figure 4-15). Prince Edward Island has the largest amount of aquaculture activity with approximately 1,100 sites distributed throughout nearly every bay and estuary (Dale Small. Jan. 2004. Fisheries and Oceans Canada. Fisheries and Aquaculture Management Branch. Charlottetown, Prince Edward Island. "pers. comm."). In New Brunswick, 70% of the sites are located between Caraquet Bay and Miramichi Bay along the northeast coast (Robert Dupuis, Officer of Leasing and Licensing Unit. Government of New Brunswick, Department of Agriculture, Fisheries and Aquaculture 2004. "pers. comm."). In Nova Scotia, aquaculture activity along the north shore occurs from Pugwash to St. Georges Bay (Government of Nova Scotia 2004*a*). In Quebec, aquaculture activity occurs along the Gaspé Peninsula (Rimouski, Baie de Gaspé, La Malbaie, and Maria), Quebec North Shore (Baie des Sept Îles, Havre-Saint-Pierre, and Blanc Sablon) and the Îles-de-la-Madeleine (Havre-aux-Maisons and Grande-Entrée); (Gouvernement du Québec 2001*a*). Activity in Newfoundland and Labrador is limited, with 17 sites from Robinsons on the southwest coast to Pistolet Bay on the Northern Peninsula (Government of Newfoundland and Labrador 2004*a*).

Table 4-11 Shellfish and finfish aquaculture sites in the Gulf of St. Lawrence.

Province	Shellfish	Finfish	Total Sites
Newfoundland and Labrador	7	10	17
Quebec	49	1	50
New Brunswick	520	0	520
Nova Scotia	65	11	76
Prince Edward Island	1,095	0	1,095
Total	1,736	22	1,758

Although finfish grow-out sites[14] (Atlantic salmon/rainbow trout) dominate the aquaculture industry in Atlantic Canada as a whole, shellfish operations (mainly oysters and blue mussels) are the major contributors in the Gulf of St. Lawrence (Canadian Aquaculture Industry Alliance 2004). Shellfish operations, account for 99% of aquaculture sites throughout the Gulf of St. Lawrence (Table 4-11, Figure 4-15). The majority of finfish (Atlantic salmon/rainbow trout) operations in the Gulf of St. Lawrence are land-based (hatcheries/fish-out ponds) and concentrated along the north shore of Nova Scotia, with a few seasonal marine grow-out sites distributed along western Newfoundland (Atlantic cod) and near Baie des Sept Îles (flounder and herring) on the Quebec North Shore.

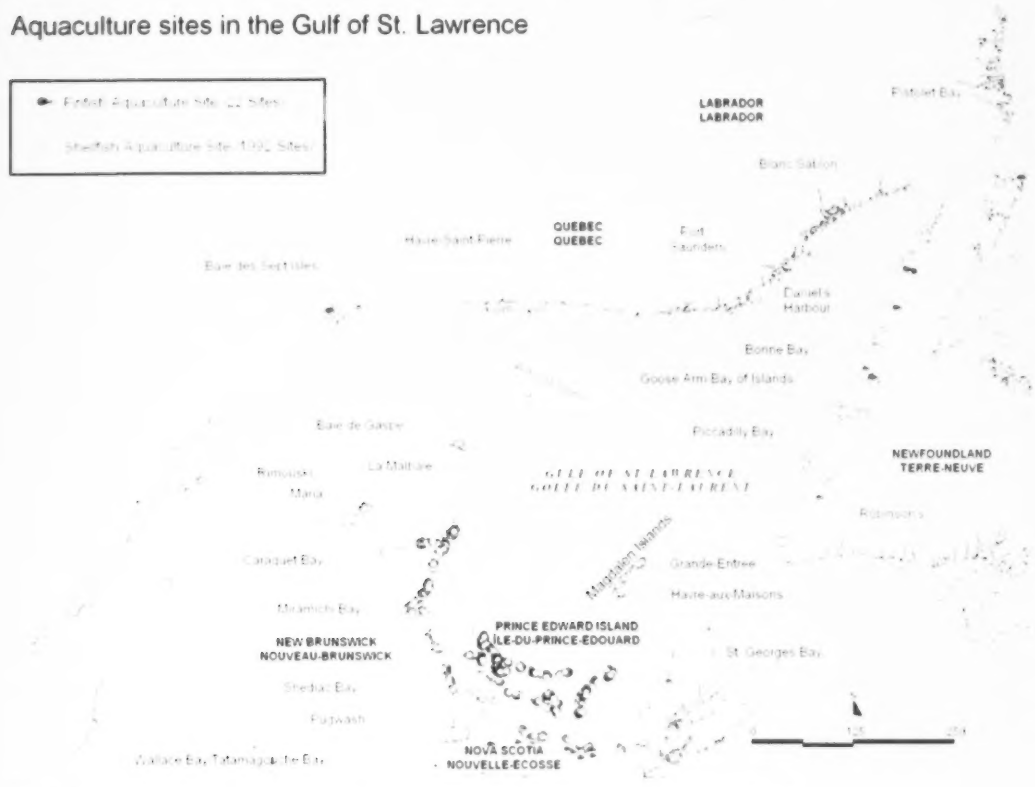

Figure 4-15 Distribution of aquaculture sites in the Gulf of St. Lawrence. 2003.

Shellfish: Oysters and blue mussels account for approximately 84% of all shellfish aquaculture activity in the Gulf of St. Lawrence (Table 4-12). However, many sites farm more than one shellfish species. Other species include sea and bay scallop, Icelandic scallop, quahogs, soft shell clam, bar clam and sea urchin.

14 Grow-out is a process whereby fish are either captured live from the wild (as in the case of cod) or reared first in a hatchery (salmon & trout) then transferred to cages in sheltered saltwater bays where they are fed a diet designed to achieve a desired size in the shortest amount of time.

Table 4-12 Shellfish aquaculture sites bordering the Gulf of St. Lawrence by province.

Province	Blue Mussel	Oyster	Sea Scallop	Icelandic Scallop	Bay Scallop	Quahaug	Soft Shell Clam	Bar Clam	Sea Urchin	Total
NL	6	-	1	-	-	-	-	-	-	7
Quebec	25	-	19	2	-	-	2	-	8	56
NB	28	507	20	-	12	93	33	75	1	769
NS	10	45	1	-	3	2	2	1	1	65
PEI	284	776	3	-	-	1	31	-	-	1,095
Total	353	1328	44	2	15	96	68	76	10	1,992

*** A number of aquaculture sites contain more than one species, and may be accounted for in more than one column of the table.**

Blue mussel (*Mytilus edulis*) farms are widely distributed throughout the Gulf of St. Lawrence, with Prince Edward Island accounting for 81% of sites (Table 4-12). The highest concentrations occur along northern and eastern Prince Edward Island (Figure 4-15); (Dale Small. Jan. 2004. Fisheries and Oceans Canada. Fisheries and Aquaculture Management Branch. Charlottetown, Prince Edward Island. "pers. comm."). Other operations occur intermittently along New Brunswick's east coast (8%), the Nova Scotia north shore (3%), the Gaspè Peninsula, Îles-de-la-Madeleine, North Shore of Quebec (7%), and western Newfoundland and Labrador (1%). Virtually all Canadian-farmed blue mussels are grown in suspension[15] as opposed to being grown on the bottom.

American oyster (*Crassostrea virginica*) occurs naturally and within farmed cultures throughout the southern Gulf of St. Lawrence, with the largest populations (beds) occurring along the coasts of New Brunswick, Prince Edward Island and Nova Scotia. Off-bottom farming is most commonly used in the southern Gulf of St. Lawrence.[16] Oyster landings are generally a combination of landings from both natural and farmed beds. Oyster sites are predominant along the western half of Prince Edward Island, eastern New Brunswick (higher concentrations along the northeast coast) and major bays along the Nova Scotia north shore (Figure 4-15). More than 1300 oyster sites exist within the Gulf of St. Lawrence with Prince Edward Island, New Brunswick and Nova Scotia accounting for 58%, 38% and 4% of sites respectively (Table 4-12).

The aquaculture industry is continuously experimenting with a number of other shellfish species which occur naturally throughout the Gulf of St. Lawrence. Sea-scallop operations occur throughout the Gulf of St. Lawrence but are mostly concentrated along northeastern New Brunswick, the Gaspè Peninsula, Îles-de-la-Madeleine, and Baie des Sept Îles (Figure 4-15). An experimental Icelandic scallop operation has been established near Havre-Saint-Pierre on the Quebec North Shore and sea urchin operations have been developed near Rimouski and Blanc Sablon. An experimental grow-out site for lobster, snow crab, and rock crab is located near Baie des Sept Îles. Soft-shelled clam, bar

15 Typically, long lines consist of 600-ft. ropes anchored securely at both ends, and supported by floats tied at intervals along their length. Hundreds of plastic mesh or rope collectors are hung on the long lines just before the spat is expected to settle in early summer. By fall, most settled spat has grown to about 15 mm. The spat is then stripped off the collectors and loaded into lengths of mesh tubing called socks. The socks are then tied at intervals along another long line where the mussels will grow to market size. This takes 18 months to 3 years, depending on location, water temperature, and the availability of plankton. This technique allows for faster growth and, higher meat yield, thus eliminating pearls.

16 This technique uses rafts and floating long lines. Collectors ropes coated with a mixture of cement and lime are suspended in the water to collect the settling larvae spare. The collected spat are grown in suspension until they reach the desired length. Finally, they are separated from the collectors and either planted on the bottom or held in suspension. Oysters in suspension grow faster and develop plumper meats than those grown on the bottom. It takes approximately 2-3 years to grow an oyster to market size in suspension versus 5-8 years on the bottom.

clam and quahaug operations occur along much of the New Brunswick coast, and intermittently along Nova Scotia, western Prince Edward Island and the Îles-de-la-Madeleine.

Finfish: Finfish operations account for only 1% of aquaculture sites in the Gulf of St. Lawrence (Table 4-13). These sites are predominantly land-based and concentrated along the Nova Scotia north shore, with a few marine grow-out sites occurring along western Newfoundland and near Baie des Sept Îles on the Quebec North Shore (Figure 4-15; Table 4-13). Climate and ice conditions in the Gulf of St. Lawrence are not well suited for marine finfish farming with the techniques used today. In the marine environment, finfish are generally raised in floating cages. These cages are susceptible to extensive damage by heavy ice conditions in the Gulf of St. Lawrence. Land-based operations consist of hatcheries, grow-out sites and fish-out ponds for Atlantic salmon, speckled trout and rainbow trout. Rectangular or circular tanks or concrete runways are generally used for eels. Marine sites along western Newfoundland are used on a seasonal basis for Atlantic cod grow-out. In Baie des Sept Îles, an experimental grow-out site exists for herring and winter flounder.

Table 4-13 Finfish aquaculture sites bordering the Gulf of St. Lawrence by province.

Province	Atlantic Salmon, Speckled/Rainbow Trout	Atlantic Cod	Other	Total
Newfoundland and Labrador	2	7	1	10
Quebec	0	0	1	1
New Brunswick	0	0	0	0
Nova Scotia	11	0	0	11
Prince Edward Island	0	0	0	0
Total	13	7	2	22

Atlantic salmon (*Salmo salar*) is an anadromous species that lives in fresh water for the first two to four years of its life, then migrates to sea, usually for a period of one to two years, before returning to fresh water to spawn. It is widely distributed throughout the Gulf of St. Lawrence, but has experienced decline over the past two decades, resulting in a moratorium on commercial harvesting. Atlantic salmon farming has experienced significant growth in recent years, dominating the industry in Atlantic Canada and Canada overall. In contrast, Atlantic salmon farming in the Gulf of St. Lawrence is limited to land-based hatcheries, mostly along the Nova Scotia north shore, where the salmon are raised to smolt size in fresh water. They are then transferred to floating sea cages outside the Gulf of St. Lawrence (ex. Bay of Fundy and other marine areas), where they remain for about 18 months until they are ready for market.

Rainbow trout (*Oncorhynchus mykiss*) are native to western North America and were introduced into Newfoundland and Labrador in 1887, New Brunswick and Nova Scotia in 1899, and Prince Edward Island in 1925. The species prefers cool, clear lakes, ponds, and streams, but can tolerate warm water and may migrate to sea (Steelhead). The rainbow trout is commonly used for fish-farming and as a standard laboratory animal for tests of water quality. In the Gulf of St. Lawrence, mainly along the Nova Scotia north shore, farming of rainbow trout is confined to land-based hatcheries and fish-out ponds (Figure 4-15). Hatchery-raised trout are often transferred to marine grow-out sites outside the Gulf of St. Lawrence (i.e. Bay of Fundy and Southern Newfoundland and Labrador) where marine conditions are more favourable.

Atlantic cod (*Gadus morhua*) are widely distributed throughout the Gulf of St. Lawrence and adjacent waters. Two stocks have been identified in the Gulf of St. Lawrence: 4RS, 3PN and 4TVN.

Historically, it is probably the most heavily exploited of all marine species. Following a four year moratorium (1993 – 1996) in the Gulf of St. Lawrence, commercial fish harvesters were permitted to fish for Atlantic cod on a limited basis. The use of cod grow-out traps became a common practice with fish harvesters of western Newfoundland and Labrador during this period (Figure 4-15). The fish are held and fed in grow-out sites for a few months and harvested during the fall and early winter when prices tend to be higher.[17]

Other finfish that have been introduced to the aquaculture industry in the Gulf of St. Lawrence include arctic char (*Salvelinus alpinus*), speckled trout (*Salvelinus fontinalis*) and American eel (*Anguilla rostrata*). Speckled trout are generally used to stock fish-out ponds, while char are raised in hatcheries and transferred to fresh water or marine grow-out sites. One land-based eel operation exists near the community of Robinsons, on the southwest coast of Newfoundland and Labrador (Figure 4-15). An experimental grow-out site for herring and winter flounder exists in Baie des Sept Îles.

Production and Value: Production and value data presented below were available from all provinces for 2001 only at time of writing. However, this data was available only for the provinces as a whole, thus it was impossible to extract data for the Gulf of St. Lawrence alone. New species are continuously being introduced to the aquaculture industry and are initially produced only by a few or single operations. However, production and value data for several minor species are often grouped together for confidentiality purposes.

Aquaculture operations throughout the Atlantic provinces produced approximately 73,000 tonnes of product in 2001, valued at nearly $292.5 million (Table 4-14); (Government of Newfoundland and Labrador 2004*b*, Government of Nova Scotia 2004*b*, Government of New Brunswick 2002*b*, Gouvernement du Québec 2004*c* and Statistics Canada 2004). Atlantic salmon, rainbow trout and speckled trout grow-out sites accounted for most of the production, especially in New Brunswick (almost entirely in the Bay of Fundy), but except for a few land-based hatcheries, all Atlantic salmon and trout production occurred outside the Gulf of St. Lawrence. Shellfish (mainly mussel and oyster) accounted for at least 35% of the total Atlantic production and approximately 14% of the Atlantic value in 2001. The major production areas in the Gulf of St. Lawrence are centered on Prince Edward Island and northeastern New Brunswick (Figure 4-15). In 2001, Price Edward Island accounted for approximately 79% of shellfish production in Atlantic Canada. Less than one percent of Newfoundland and Labrador's aquaculture production occurs in the Gulf of St. Lawrence.

17 Atlantic cod are caught in traditional and/or Japanese cod traps. The cod are then transferred and towed to grow-out sites in either plastic cages or buoyed net systems. The cod are fed and grown out in these same net systems for a period of 4 to 6 months (generally June – December). This practice has been known to double the weight of cod over a period of 100 days.

Table 4-14 2001 Aquaculture production and value statistics for the five provinces bordering the Gulf of St. Lawrence.

Province		Atlantic Salmon	Trout (Rainbow/Speckled)	Blue Mussels	Oysters	*Other Species	Total
Newfoundland and Labrador[18]	Landings (tonnes)	1,092	1,719	1,452	-	207	4,470
	Value ($,000)	5,200	9,752	3,929	-	525	19,406
Quebec[19]	Landings (tonnes)	-	2,903	492	-	252	3,647
	Value ($,000)	-	15,610	640	-	1,270	17,520
New Brunswick [20]	Landings (tonnes)	33,900	550	750	744	-	35,944
	Value ($,000)	180,010	6,100	825	2,040	-	188,975
Nova Scotia[21]	Landings (tonnes)	2,614	2,986	1,619	420	714	8,353
	Value ($,000)	14,361	9,777	2,002	1,203	8907	36,250
Prince Edward Island[22]	Landings (tonnes)	-	-	17,506	2,731	76	20,313
	Value ($,000)	-	-	23,200	6,324	733	30,257
Total Landings (tonnes)		37,606	8,158	21,819	3,895	1,249	72,727
Total Value ($,000)		199,571	41,239	30,596	9,567	11,435	292,408

*** Includes hatcheries and fishout ponds for Atlantic salmon and speckled/rainbow trout, and aquaculture sites for new candidate species (quahaug, bay scallop, soft shell and bar clam, sea urchin, Artic char, Atlantic cod, and haddock).**

Blue mussel production in Atlantic Canada was valued at $30.5 million in 2001 (Table 4-14). The industry was dominated by Prince Edward Island, which accounted for 80% of the total production. Nova Scotia and Newfoundland and Labrador each accounted for seven percent of the total production, mainly from operations outside the Gulf of St. Lawrence. New Brunswick and Quebec accounted for four percent and percent respectively.

Oyster production in Atlantic Canada was valued at over $9.5 million in 2001 (Table 4-14). Prince Edward Island accounted for 70% of the total production, while New Brunswick and Nova Scotia accounted for 21% and 13% respectively. Production in New Brunswick is concentrated entirely along

18 Government of Newfoundland and Labrador. Department of Fisheries and Aquaculture. Aquaculture production and value (Accessed 2004).

19 Gouvernement du Quebec, Agriculture, Pecheries et Alimentation. En un coup d'oeil : Portrait statistique du secteur – edition 2002.

20 Government of New Brunswick, Department of Agriculture, Fisheries and Aquaculture. Sectors in Review – Aquaculture Sector.

21 Government of Nova Scotia, Department of Agriculture and Fisheries. Statistics – Aquaculture Production Sales of Market Sized Products.

22 Statistics Canada. Aquaculture Statistics (2004). Catalogue No. 23-222-XIE http://www.statcan.ca/english/freepub/23-222-XIE/23-222-XIE2004000.pdf (Accessed 2004).

its east coast. Oyster production in Nova Scotia occurs along the north shore and other coastal areas outside the Gulf of St. Lawrence. Approximately 63% of Nova Scotia's oyster operations are located in Wallace Bay and Tatamagouche Bay (Figure 4-15) within the Gulf of St. Lawrence.

Other species accounted for $11.5 million in production value in 2001 (Table 4-14). Nova Scotia accounted for 78% of this value, through bar clam, soft shell clam, sea and bay scallop, quahaug, and Arctic char production. This includes activity both inside and outside the Gulf of St. Lawrence. Sea scallop, Icelandic scallop, and sea urchin production in Quebec accounted for 11%, and soft shell clam and sea scallop production in Prince Edward Island represented 6% of the value for that year. Newfoundland and Labrador accounted for 5%. Although Table 4-14 does not indicate farming of other species in New Brunswick, approximately 27% of sites contain other species such as sea scallop, bay scallop, quahaug, soft shell clam, bar clam, and/or sea urchin. Many of these sites may only be in the developmental stage.

4.3.3 Summary

The aquaculture industry has become a major contributor to the economy of many rural municipalities throughout the Gulf of St. Lawrence, supported by an increased global demand for seafood products and a downturn in a number of commercial fisheries in recent years. Shellfish production in the Gulf of St. Lawrence increased by 17% to 33,900 tonnes in 2001 compared to 2000 (Howllet and Rayner 2003). This was mainly due to increased mussel and oyster production in Prince Edward Island and New Brunswick. The aquaculture industry in Atlantic Canada will continue to grow as the demand for seafood increases and the technology for new and emerging species such as seaweed and sea cucumbers is developed and improved. While Prince Edward Island, Nova Scotia and New Brunswick have taken full advantage of their provinces' aquaculture potential (Unic Marketing Ltd 2003), Newfoundland and Labrador, and Quebec has yet to do the same. Aquaculture potential in these provinces is limited to the number of secluded bays and inlets, which provide protection from the elements of the Gulf of St. Lawrence. Given that the Gulf of St. Lawrence is a partially enclosed sea where the marine space is limited and biodiversity is uniquely adapted, further growth of the aquaculture industry raises several ecological and socio-economic concerns. For example, the impact of biological waste, parasites and diseases on wild stocks and the marine habitat are largely unknown. Escapements from aquaculture operations may result in introduction of exotic species and the displacement of native species through the spread of parasites and diseases. There is also potential for user conflicts to develop among aquaculture operations, commercial fish harvesters and other users of marine areas. Some traditional inshore fishing areas have already been displaced in favour of aquaculture leases. The growing marine tourism and recreational boating industry will also likely result in increased competition for available marine area and potential collisions with cages. As the aquaculture industry continues to grow, oceans managers in the Gulf of St. Lawrence will require a greater understanding of the distribution of various types of aquaculture operations, their potential impacts and user conflicts.

4.3.4 Information Gaps

There is very little consistency in the process of collecting and maintaining data among the five provinces. Harvest and value data, for the most part, were only available for each province as a whole. To understand the full value of the industry throughout the Gulf of St. Lawrence, it would be necessary to further breakdown this data for areas along the Gulf of St. Lawrence and also obtain the export value of product. More research may be required to obtain a better understanding of the ecological impacts of aquaculture activity (potential to spread disease to wild species; escapement, introduction of foreign and potentially invasive species, the effects of accumulated biological waste on local species and marine habitat) and potential conflicts with other ocean activities.

4.4 OIL AND GAS ACTIVITY

4.4.1 Background

Oil and gas activity in the Gulf of St. Lawrence and surrounding coastal areas is mainly exploratory, dating back about 160 years. While onshore seismic and drilling operations occur periodically along coastal areas, seismic operations account for the majority of offshore activity, with only a few exploratory wells drilled to date. Oil and gas production in the Gulf of St. Lawrence is limited to a few minor onshore discoveries, but has yet to produce a significant discovery to the magnitude of those of the Atlantic offshore (Grand Banks and Scotian Shelf) or western Canada. Atlantic Canada offshore accounts for approximately seven percent of Canada's total production of oil and natural gas, but is expected to increase as projections show a 10% decline in the production of light and medium gravity crude oils from the western Canada sedimentary basins by 2010. Meanwhile, Canada's petroleum exports are expected to grow substantially early in the 21st century, as recent studies by the U.S. Department of Energy suggests that U.S. demand for petroleum products will increase by at least 30% by 2015. This will result in a change in geographical diversification of the Canadian petroleum industry, which is already well underway. Combined with record high oil prices in recent years, these factors have generated a renewed interest in the exploration of sedimentary basins in Atlantic Canada. While there have been major discoveries off the Grand Banks and Scotian Shelf, many Atlantic offshore basins are still left unexplored including the Gulf of St. Lawrence.

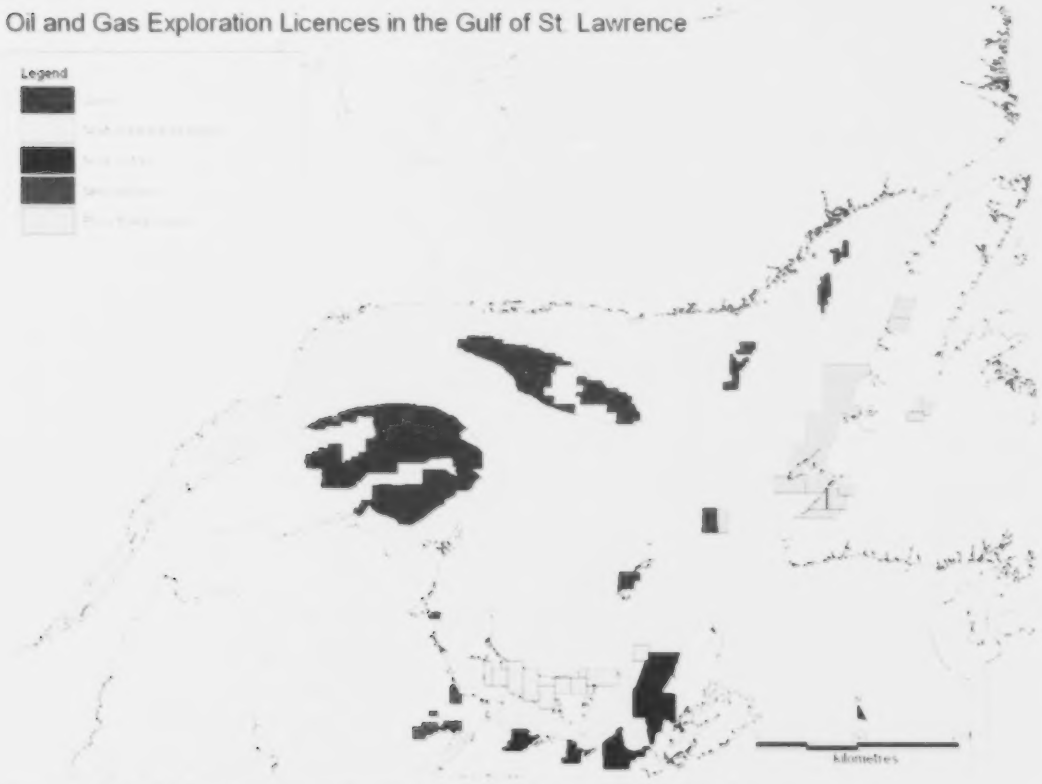

Figure 4-16 Offshore/onshore exploration licenses along the Gulf of St. Lawrence. 2006.

4.4.2 Administrative Structure

The administrative authority for oil and gas resources in the Gulf of St. Lawrence and surrounding coastal areas is shared by four Atlantic provinces, Quebec and the Government of Canada. A tentative offshore boundary agreement was reached between the four Atlantic provinces (1964) and Quebec in 1972; an agreement, which was overruled by a tribunal in 2001 to settle an offshore boundary dispute between Nova Scotia and Newfoundland and Labrador (Gray 2002). During the 1980s, the Government of Canada signed individual Atlantic Accords with the provinces of Nova Scotia[23], and Newfoundland and Labrador[24], thus providing for federal/provincial administration and revenue sharing of offshore resources within the respective provincial jurisdictions. Under these Accords, two federal/provincial boards were established to administer offshore oil and gas activities on behalf of the Government of Canada, and the provinces of Newfoundland and Labrador (Canada – Newfoundland and Labrador Offshore Petroleum Board (CNLOPB)), and Nova Scotia (Canada – Nova Scotia Offshore Petroleum Board (CNSOPB)), (Table 4-15). Oil and gas interests within the offshore and frontier lands[25] of New Brunswick, Prince Edward Island and Quebec fall under the authority of the National Energy Board (Table 4-15, Figure 4-17), with the exception of the estuary, which is administered by the province of Quebec (Table 4-16).

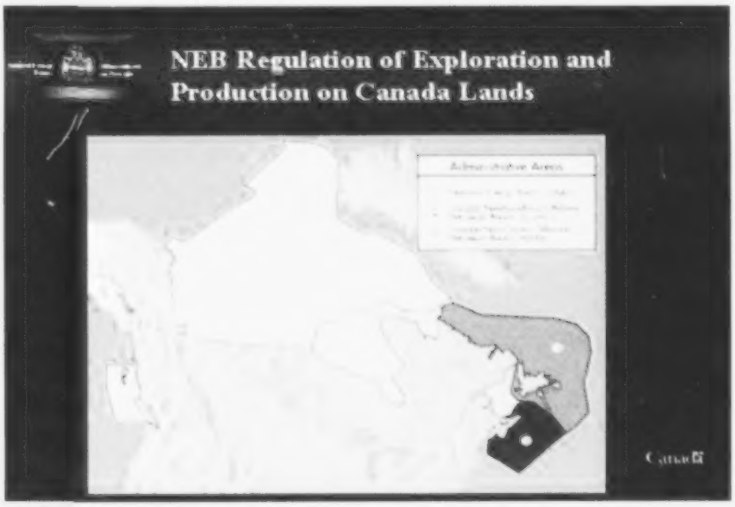

Figure 4-17 Administrative areas for Canada's offshore oil and gas interests. Courtesy of Natural Resources Canada. 2004.

Onshore oil and gas activity within all five provinces is administered by the respective provincial governments (Table 4-16). Table 4-15 and Table 4-16 provide an overview of administrative authorities and applicable legislation for oil and gas activities in the Gulf of St. Lawrence and the five adjacent provinces.

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23 Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act (1988, c. 28) http://laws.justice.gc.ca/en/C-7.8/index.html

24 Canada-Newfoundland Atlantic Accord Implementation Act (1987, c. 3) http://laws.justice.gc.ca/en/C-7.5/index.html

25 Frontier lands means lands that belong to Her Majesty in right of Canada, or in respect of which Her Majesty in right of Canada has the right to dispose of or exploit the natural resources, and that are situated in: (a) the Northwest Territories, Nunavut or Sable Island, or (b) submarine areas, not within a province, in the internal waters of Canada, the territorial sea of Canada or the continental shelf of Canada; but does not include the adjoining area, as defined in section 2 of the Yukon Act (Canada Petroleum Resources Act, 1995).

Table 4-15 Administrative authorities and legislation for offshore oil and gas activities in the Gulf of St. Lawrence and estuary.

Authority	Legislation
Newfoundland and Labrador	
Canada-Newfoundland and Labrador Offshore Petroleum Board	Canada- Newfoundland Atlantic Accord Implementation Act
Nova Scotia	
Canada-Nova Scotia Offshore Petroleum Board	Canada-Nova Scotia Petroleum Resources Accord Implementation Act
New Brunswick; Prince Edward Island; Quebec (estuary excluded)	
National Energy Board	Canada Oil and Gas Operations Act Canada Petroleum Resources Act
Quebec (estuary only)	
Ministry of Natural Resources, Wildlife and Parks	Mining Act

Table 4-16 Administrative authorities and legislation for onshore oil and gas activities for the five provinces bordering the Gulf of St. Lawrence and estuary.

Authority	Legislation
Newfoundland and Labrador	
Department. of Mines and Energy	Petroleum and Natural Gas Act
Nova Scotia	
Department of Energy	Petroleum Resources Act
New Brunswick	
Department of Natural Resources	Oil and Natural Gas Act
Prince Edward Island	
Environment, Energy and Forestry (Energy and Minerals Division)	Oil and Natural Gas Act
Quebec	
Ministry of Natural Resources, Wildlife and Parks	Mining Act

The process of issuing exploration permits and licences vary among jurisdictions and is based on current legislation for oil and gas (Table 4-15 and Table 4-16) administered by the respective administrative authorities. The Canada – Newfoundland and Labrador Offshore Petroleum Board, Canada – Nova Scotia Offshore Petroleum Board, National Energy Board, and the administrative authorities for the four Atlantic provinces all use a competitive bidding system. The competitive bidding system provides exploration companies with the opportunity to bid on nominated parcels of land approved by the issuing administrative authority for exploration, in which the successful bidder receives an exploration permit or licence for a predetermined period. Quebec, on the other hand, administers the issuance of exploration permits and licences through a free mining (first come, first served) process (Government of Quebec 2001).

4.4.3 Overview of Oil and Gas Activity

The Gulf of St. Lawrence consists of two sedimentary basins: the lower Paleozoic Anticosti Basin and the upper Paleozoic Maritimes Basin); (Figure 4-18). The Anticosti Basin encompasses the northern Gulf of St. Lawrence and coastal areas of Quebec, western Newfoundland and southern Labrador. The Maritimes Basin extends throughout the southern Gulf of St. Lawrence encompassing offshore areas south of Anticosti Island, and coastal areas of eastern New Brunswick, northern Nova Scotia, Prince Edward Island, Îles-de-la-Madeleine and southwestern Newfoundland and Labrador. In Quebec, the Anticosti and Maritimes basins cover 225,000 km^2; 57% is offshore (Gouvernement du Québec 2001*b*). Both basins have abundant source rocks, variably permeable and porous reservoir rocks, numerous traps, and yet both basins remain under-explored.

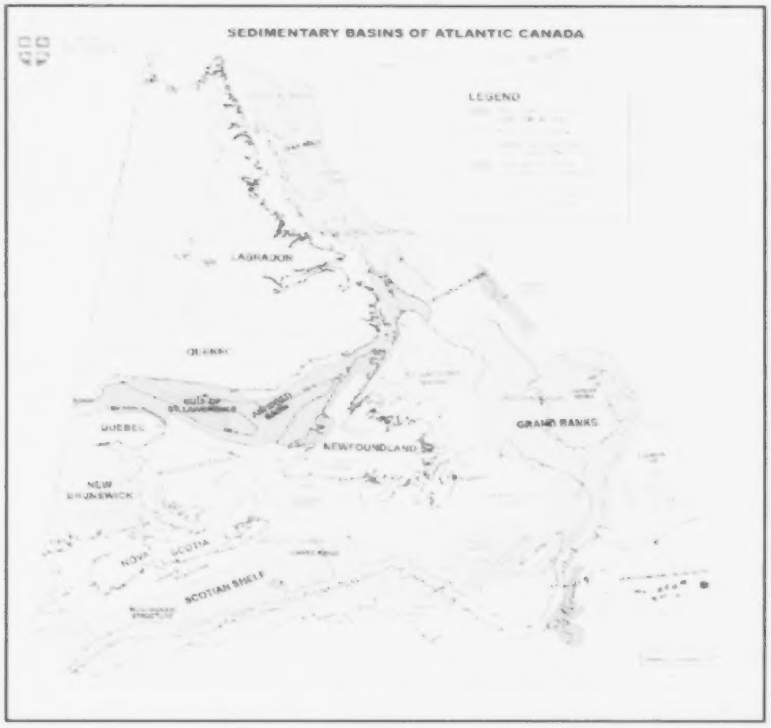

Figure 4-18 Sedimentary basins of Atlantic Canada. Courtesy of the Government of Newfoundland and Labrador: Department of Mines and Energy. 2004.

Oil and gas exploration in the Gulf of St. Lawrence and surrounding coastal areas originated onshore during the mid 1800s. A number of shallow wells were drilled along the Gaspé Peninsula, western Newfoundland, western Cape Breton, and within the oil shales of southeastern New Brunswick. Offshore drilling first occurred off Prince Edward Island in Hillsborough Bay during the 1940s. All exploratory drilling prior to the 1940s occurred without the support of seismic operations. Seismic activities date back to the 1940s for onshore operations and the 1960s for offshore operations. Seismic operations greatly enhanced the potential of identifying basins which may contain significant deposits of oil or natural gas.

Airguns are commonly used in the marine environment including the Gulf of St. Lawrence. An airgun array located near the stern of the vessel is positioned below the surface of the water, releasing compressed air through the water column and the ocean floor, sending powerful sound waves through rock layers below. The sound waves are reflected back to the surface and are recorded by a series of

hydrophones attached to one or more streamers that extend (approximately 6 km) from the sstern of the boat. The recorded data provides information on the depth, position and shape of undergrounnd geological formations that may contain crude oil or natural gas (Peterson 2004). Seismic airgun arrays generate maximum noise levels at source in the 200 – 250 decibel range with a detection ramge exceeding 100 km (Davis et al. 1998). During the early 1970s, the Atlantic Geoscience Centtre and industry collaborated to produce seismic profiles of the Gulf of St. Lawrence, covering somee 14,000 and 40,000 km of sea floor respectively. More than 60,000 km of offshore seismic reflectiom data has been acquired in the Gulf of St. Lawrence since the 1960s (Figure 4-19). A number of offshore seismic operations have taken place within recent years including activity within the Laurentian Channel (2002); offshore western Cape Breton (2003), and within the Lower estuary (2004)).Onshore seismic operations involve laying a line of receivers called geophones along the ground, which records seismic waves from explosives inserted into a series of drilled holes. A more recent onshore process includes a method called vibroseis, where shock waves are produced using a vibrator vehicle. Two-dimensional (2-D) seismic surveys cover large areas, and account for the majority of seismic activity within the Gulf of St. Lawrence to date. Three dimensional (3-D) seismic operations are required to further explore smaller areas of interest that have been previously identified by 2-D operations, providing a more detailed picture of the rock formation (Peterson 2004).

Figure 4-19 Industry seismic activity conducted in the Gulf of St. Lawrence and estuary from 1965 to 1992. Variation in line colouring represents individual seismic projects. Courtesy of the Geological Survey of Canada. 2004.

Exploratory drilling has been ongoing periodically since the mid 1800s, but only with the support of seismic operations since the mid 1900s. Onshore drilling accounts for the majority of drilled wells, with only a few offshore wells drilled in the Gulf of St. Lawrence to date. Directional drilling[26] is a process that has been used in recent years to access offshore reservoirs from onshore; a practice which is expected to continue along coastal areas of the Gulf of St. Lawrence. Directional drilling is less expensive than offshore drilling practices and may incur fewer environmental risks (Canadian Association of Petroleum Producers 2005).

A number of recent discoveries along eastern Prince Edward Island offshore (East Point – E49 natural gas well - 1974), the Gaspé Peninsula (Galt gas field – 1983), western Newfoundland (Port au Port #1 oil well - 1994), and southern New Brunswick (McCully natural gas field - 2003) provide evidence of potential commercial deposits of oil and natural gas. These recent discoveries have generated a renewed interest for oil and gas exploration throughout the Gulf of St. Lawrence. The following sections provide a more detailed overview of past and recent exploration activities for each of the five provincial jurisdictions bordering the Gulf of St. Lawrence.

Oil and gas infrastructure (storage and transportation) within the Gulf of St. Lawrence currently support operations within other areas of Eastern and Atlantic Canada. The largest petroleum storage and transhipment facility in the Gulf of St. Lawrence is located in the Strait of Canso at Point Tupper, Nova Scotia. The facility has the capacity to store 7.6 million barrels of liquid fuels and 55,000 barrels of butane. The facility accommodates large ocean tankers, as well as smaller tankers which transport petroleum products to destinations throughout the Gulf of St. Lawrence and Great Lakes. Smaller storage facilities exist along coastal areas throughout the Gulf of St. Lawrence, supporting marine to land transhipments of petroleum products. The Maritimes and Northeast Pipeline was constructed in 1999 to transport natural gas from the Sable Offshore Energy Project to destinations in Canada and northeastern United States (Maritimes and Northeast Pipeline 2005). The pipeline, which extends from Goldboro, Nova Scotia, northeast through Nova Scotia, and southeastern and central New Brunswick (Maritimes and Northeast Pipeline 2005), has the potential to support future discoveries of natural gas within the southern Gulf of St. Lawrence and surrounding onshore areas. Meanwhile, TransCanada and Petro-Canada has proposed a methane terminal and liquefied natural gas plant for Gros-Cacouna, Quebec (Énergie Cacouna Energy 2004).

Newfoundland and Labrador: First exploration activities along western Newfoundland occurred during the 1860s with wells drilled near the communities of Parson's Pond and Deer Lake, and along the Port au Port Peninsula. A number of these shallow wells produced small quantities of oil. A second cycle of exploratory drilling occurred between 1950 and 1973, when Golden Eagle Exploration (a subsidiary of Ultramar Corporation) drilled 19 wells throughout the same areas, but was unsuccessful in discovering commercial deposits of oil or gas. A third cycle occurred more than 20 years later with Hunt/Pan Canadian drilling an offshore well south of Cape St. George (St. Georges Bay A-36 well), and several onshore wells accessing offshore basins along the Port au Port Peninsula. The Port au Port #1 well (1994), just north of Cape St. George was the only well to provide evidence of an active petroleum system in the area. In 1999, the well was farmed out to Canadian Imperial Venture Corp (CIVC), who later secured a production lease along the western portion of the Port au Port peninsula (Figure 4-16), bringing the well into production. The well has since operated intermittently due to financial and technical challenges. During the late 1990s, Vulcan Minerals and Deer Lake Oil and Gas drilled wells displaying minor shows of oil and/or gas in the Flat Bay and Deer Lake areas respectively (Government of Newfoundland and Labrador 2005). In 2002, Corridor Resources conducted 500 km of seismic activity on EL1063, just off Cape Ray (Figure 4-16); (Corridor Resources 2004). This license has since expired.

26 The ability to drill multiple wells by drilling at various angles from a stationary platform.

Approximately 12,203 km of offshore and 838 km of onshore seismic data have been acquired along western Newfoundland between 1969 and 2002. The petroleum industry invested more than $65 million on offshore oil and gas exploration along western Newfoundland from 1990 to 2003 (Canada-Newfoundland Offshore Petroleum Board 2005). As of March 2005, western Newfoundland had 0.66 million hectares of land held under permit/licence to the petroleum industry including five offshore licences totalling 0.4 million hectares, and 10 onshore exploration permits and one production lease totalling 0.26 million hectares (Figure 4-16); (Government of Newfoundland and Labrador 2005). The Government of Newfoundland and Labrador and the Canada-Newfoundland and Labrador Offshore Petroleum Board generally issue annual Call for Bids on onshore and offshore parcels of land respectively.

A number of exploration companies currently hold onshore/offshore interests along western Newfoundland including Vulcan Minerals, Contact Exploration, Deer Lake Oil and Gas, Ptarmigan Resources and TekOil.

Quebec: Oil exploration first occurred along the Gaspé Peninsula in 1836 through the discovery of oil seeping from rock layers (Lavoie and Bourque 2001). The Gaspé Peninsula was the focus of oil exploration until the 1950s, and then interest shifted to the St. Lawrence Lowlands. During the 1970s, the Quebec government founded the Société Québécoise d'Initiative Pétrolière (SOQUIP) and constructed the Institut National de la Recherche Scientifique (INRS-Pétrole) to support oil and gas exploration research along the Gaspé Peninsula (Lavoie and Bourque 2001). This initially drew major petroleum companies to the area, but interest steadily declined without a major discovery. A number of minor companies continue to conduct exploratory programs throughout the area.

Since 1995, exploration has increased along the Gaspé Peninsula, Anticosti and Îles-de-la-Madeleine, and within the Gulf of St. Lawrence, mainly due to the discovery of oil in western Newfoundland (Port au Port #1 well); (Lavoie and Bourque 2001). During 1998/99, Shell and Calpine conducted 400 km of seismic activity and drilled five exploration wells on Anticosti Island; one (Chaloupe well) of which showed a presence of oil in the area. In 2002, Junex Inc., one of the larger landholders on the Gaspé Peninsula, brought its Galt gas field into production (Junex 2005), and Corridor Resources and Foothills Minerals Inc. acquired new seismic data for their Fatima prospect (40,000 hectares) located on the Îles-de-la-Madeleine (Corridor Resources 2004). In November 2002, Hydro Quebec's Oil and Gas Division proposed a $330 million investment plan aimed at exploring and evaluating the oil and gas potential of the estuary and Gulf of St Lawrence (Stratégies St Laurent. 2004.). Opposition to the project prompted Environment Canada and Fisheries and Oceans Canada to conduct an environmental evaluation of the area, and the Quebec government to submit the project to a process of public hearings, and analysis by a panel of experts. Hydro Quebec later farmed into an agreement with Corridor Resources, obtaining 25% interest in the Old Harry[27] prospect located within the Laurentian Channel, and partnered with the Geological Survey of Canada to conduct a series of seismic surveys between Les-Escoumins and Pointe-des-Monts (Lower estuary). Since 1860, approximately 381 wells have been drilled in the sedimentary basins of Quebec. Nearly $100 million have been spent on oil and gas exploration in Quebec between 1990 and 2000 including more than $50 million on seismic activities in the St. Lawrence Lowlands and on Anticosti Island (Gouvernement du Québec 2001*b*).

In 2004, TransCanada and Petro-Canada proposed a natural gas plant and marine terminal near Rivière-du-Loup. The project comes under the name Énergie Cacouna and would consist of a methane terminal and a liquefied natural gas plant at the port of Gros-Cacouna, and a pipeline which would be connected to the rest of Quebec's natural gas pipeline system in Saint-Nicolas, near Quebec City (Énergie Cacouna Energy 2004).

27 The Old Harry prospect consists of three offshore licenses: two within Quebec boundaries and an adjacent license within the offshore boundaries of Newfoundland and Labrador.

New Brunswick: Exploration throughout New Brunswick during the past 160 years has resulted in three significant hydrocarbon discoveries. The majority of exploration has been focused along the southcentral and southeastern portions of the province. High-grade oil shales were first discovered at Albert Mines in 1849 approximately 25 km south of Moncton. No other significant discovery was made until 1909, when commercial deposits of natural gas were uncovered near Stoney Creek, just 10 km north of the Albert Mines discovery. The Stoney Creek field remained in production until 1991. In 1942, the Government of Canada drilled 79 core holes in an effort to secure oil supplies for Canada's effort in WWII. The project resulted in little success with the Albert Mines area showing the most promising results.

Shell Oil Co. was the first major petroleum company to conduct seismic operations in southeastern New Brunswick (late 1940s), followed by Chevron and Irving Oil Ltd., who farmed into an agreement with Western Decalta to conduct 1,906 km of seismic operations (1980s). In 1998, MariCo Oil and Gas Corp made a promising discovery of natural gas in its Downey #1 well (5 km south of the Stoney Creek field), but later suspended the well for future consideration (St. Peter 2000). The third significant discovery occurred in 2003 near Sussex, with Corridor Resources bringing the McCully natural gas field into production (Corridor Resources 2004). Corridor Resources and partner Potash Corporation of Saskatchewan Inc are the most active companies in New Brunswick with exploration concentrated in the south-central part of the province. Existing licences and leases surround the areas of Fredericton, Sussex and Moncton, extending to the east coast to Shediac and Bouctouche, and north of Kouchibouguac National Park (Figure 4-16). The Department of Natural Resources issued two Calls for Tenders for exploration licences during 2004 resulting in the issuance of seven exploration licences south of Moncton for a total area of 25,162 ha and work commitments of nearly $650,000 (Government of New Brunswick 2005*a*).

Nova Scotia: Nova Scotia's first exploratory well was drilled near Lake Ainslie, western Cape Breton in 1869. During the 1920s, Gulf Oil and Imperial Oil drilled 20 onshore exploration wells with little success. In 1956, the provincial government passed the Petroleum and Natural Gas Act to guide onshore exploration activity. During the 1970s, significant discoveries made along the Scotian Shelf included Sable Island (1971), Cohasset (1973) and Venture (1979) fields.The potential of finding active petroleum systems in similar basins within the Gulf of St. Lawrence has certainly been reinforced by these projects. Between 1978 and 1981, traces of oil discovered during a base metal drilling program in Inverness County, led Chevron Standard to drill 13 exploratory wells (Government of Nova Scotia 2004*d*). In 1999, the Maritimes and Northeast Pipeline, a 1,300 km transmission pipeline was constructed, commencing at the Sable Offshore Energy Inc. gas plant in Goldboro, Nova Scotia, and extending through central and northern Nova Scotia, and southern New Brunswick, connecting with the Portland Natural Gas Transmission, Tennessee Gas Transmission, and Algonquin Gas Transmission systems (Maritimes and Northeast Pipelines 2005). This pipeline system also serves Canadian markets in Nova Scotia and New Brunswick through the following laterals (pipelines): Point Tupper Lateral (60 km), Halifax Lateral (124 km), Moncton Lateral (12 km), and the Saint John Lateral (111 km); (Figure 4-20). The pipeline transported the first gas from the Sable project later that year (Government of Nova Scotia 2004*d*).

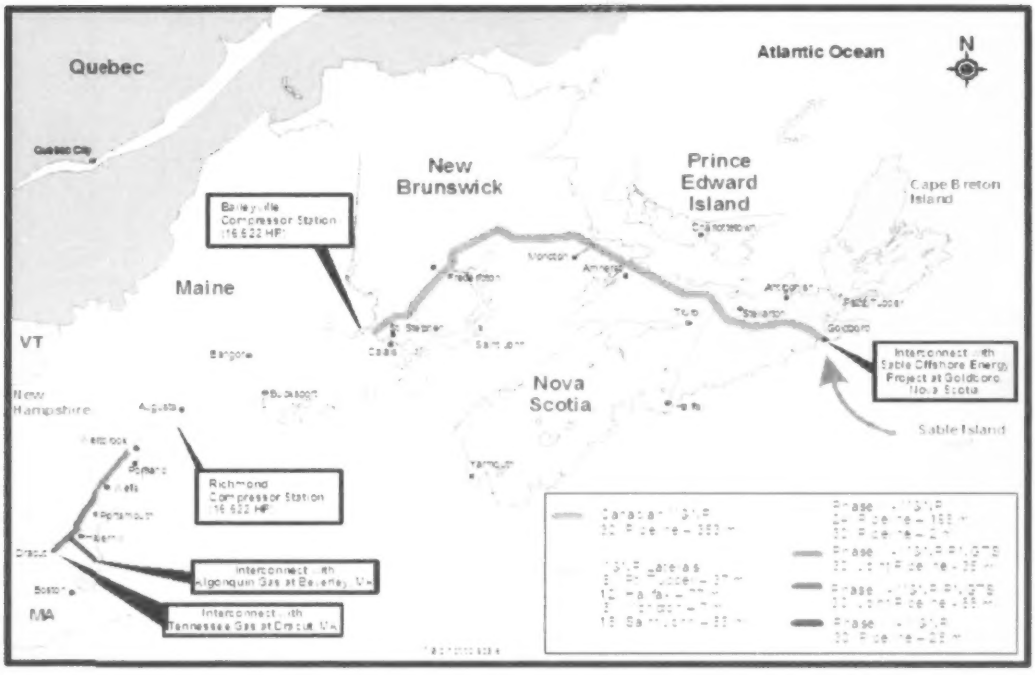

Figure 4-20 Maritimes and Northeast Pipeline. Courtesy of Duke Energy, Emera Inc. and Exxon Mobil. 2005.

Corridor Resources decision to conduct an offshore seismic operation along western Cape Breton (EL 2368) prompted an extensive ecological analysis of the area prior to being approved in 2003 (Figure 4-16). Exploration lease EL 2368 is the only active offshore exploration lease along the north shore of Nova Scotia, which is located approximately 24 km west of Cheticamp and 8 km east of the H.B.-Fina East Point E-49 natural gas discovery off eastern Prince Edward Island (Figure 4-16); (Corridor Resources 2004). Eight onshore exploratory wells have been drilled in Nova Scotia since 1999, with two more and several seismic programs expected to be completed by the end of 2004. Eight exploration agreements and a coalbed methane (natural gas from coal) agreement between industry and the province account for 1.6 million hectares of land holdings and $10 million in work commitments over the next two to three years. Devon Canada Corporation remains the largest onshore landholder with nearly 1 million hectares of land. Contact Exploration holds exploration interest near Pictou and has farmed into Devon Canada's Antigonish agreement (Government of Nova Scotia 2004*c*).

Prince Edward Island: In 1943, Island Development Co. drilled Canada's first offshore well off Prince Edward Island in Hillsborough Bay. During the 1950s, Imperial Oil drilled three onshore wells along the western portion of the Island. The 1970s and early 1980s saw a series of wells drilled along northern Prince Edward Island and the Island's eastern offshore area. The most success came from Hudson Bay Oil and Gas Co.'s H.B.-Fina East Point E-49 well, drilled offshore near the northeastern tip of the Island in 1974 (Fig 4-16). The well had gas shows of 5.5 million cubic feet per day within sandstones that are closely associated with coal beds, which are age equivalents of the Pictou Coalfield in Nova Scotia. The well was later abandoned, as it was not considered commercially viable on its own. The E-49 well falls within exploration permit # 94-01, issued by the province under the Oil and Natural Gas Act, and Significant Discovery Licence # 082, issued by the Government of Canada in 1987 under the Canada Petroleum Resources Act (Government of Prince Edward Island 2005). Exploration Permit 94-01 is currently held by BP Canada Energy Co. of Calgary and is the only existing offshore permit in Prince Edward Island waters. The Department of Energy renews the

licence on an annual basis as the province is currently undergoing discussions with the federal government regarding authority over offshore resources (Estabrooks, R., Energy Advisor. Government of Prince Edward Island: Department of Environment, Energy and Forestry "pers. comm."). Corridor Resources and Prince Edward Island Gas Co. continued exploring Prince Edward Island throughout the late 1990s by drilling a number of wells along the northern portion of the Island. Since 2002, Rally Energy Corp. and Petro-Worth Resources completed seismic profiles of their respective land holdings. Prince Edward Island's hydrocarbon potential has yet to be fully assessed; as to date only 18 exploratory wells and one re-entry well have been drilled in and around the province between 1944 and 2004, with more than 1500 km of seismic data acquired throughout the province since 1942. In July 2004, Corridor Resources acquired two new exploration licences in the west-central portion of Prince Edward Island, an area that had previous shows of natural gas. In 2004, the province issued a Call for Bids on four parcels of land: three on the eastern end of the Island (totalling 19,000 ha); and one in the central area of the province (55,536 ha).

4.4.4 Summary

The history of oil and gas activity within and around the Gulf of St. Lawrence has been limited to seismic operations and onshore drilling, with only a few offshore wells drilled to date. Since 1960, more than 60,000 km of seismic data has been acquired throughout the Gulf of St. Lawrence. Further research may be required to learn more about the effects of seismic airgun arrays on the behaviour of marine species within the Gulf of St. Lawrence.

The oil and gas industry in the Gulf of St. Lawrence is still in its infancy as many geological plays remain untested. Major discoveries off the Grand Banks and Scotian Shelf have generated a renewed interest in the Atlantic offshore including the Gulf of St. Lawrence. This interest is reinforced by record high oil prices, projected downturns in the supply of high grade oil and gas from western Canada basins, a projected increase of exports to the United States, and signing of new revenue sharing agreements between the Government of Canada and the provinces of Newfoundland and Labrador, and Nova Scotia.

Meanwhile, untested structures within the Gulf of St. Lawrence present many exploratory and developmental challenges, owing to the scarcity of modern day (3D) seismic data and application of more efficient drilling technologies. Other challenges, including geological and reservoir risks and a lack of industry infrastructure in the area may have negative implications on developmental costs and timelines. This is especially true with regard to a cost effective and safe system for transporting produced oil to markets.

Eight administrative authorities share the responsibility for oil and gas exploration and development in the Gulf of St. Lawrence and surrounding coastal areas. It is important that these authorities take an integrated and collaborative approach towards ensuring the sustainability and integrity of this distinct ecosystem, and minimizing ocean user conflicts while maximizing the resource potential of the oil and gas industry.

The effects of drilling waste (spent drilling mud and drill cuttings) on benthic communities is a primary environmental concern, while data is limited regarding the effects of drilling noise on marine species. Hurley and Ellis (2004) provide a literature review on the environmental effects of offshore exploratory drilling, noting considerable consistency in data from a number of offshore drilling projects (Gulf of Mexico, North Sea, Beaufort Sea and eastern Canada). The research based on chemical indicators of drilling mud note that multiple wells at the same location had much larger zones of detection (max 8000 meters) than single wells (max 1000 meters). The review noted changes in the diversity and abundance of benthic organisms within 1000 meters of drill sites, but benthic communities beyond this area generally return to baseline conditions within one year after drilling ceased. The review also notes that drilling wastes particles such as bentonite and barite interferes with

the growth and reproduction process of filter feeding species such as sea scallops. Accidental discharges and blowouts are also major concerns which may occur both onshore and offshore.

It is important to treat the Gulf of St. Lawrence as a single ecosystem due to its distinct physical features (bathymetry, influx of freshwater drainage form the Great Lakes and St. Lawrence Basin, complex network of currents, seasonal ice coverage, and restricted exchange of marine water with the offshore North Atlantic) and high biodiversity (marine species and habitat). Unlike other offshore locations, the Gulf of St. Lawrence is characterised as an Inland Sea, as such oil and gas exploration may have different environmental effects and consequences than in more open marine environments.

4.4.5 Information Gaps

It is difficult to stay up to date on this activity as the source of information is directed from eight jurisdictions throughout the Gulf of St. Lawrence. Furthermore, the issuing and expiration of exploration licenses is sporadic. More research is required to better understand the impact seismic and drilling operations may have on the behaviour of marine species (migration, spawning and feeding behaviour); effects at various life cycles (eggs and larvae); on sessile species (molluscs) and marine habitat. Furthermore, one must understand the physical components of the Gulf of St. Lawrence to determine the level of impact these activities may have on marine species and habitat.

4.5 MARINE TRANSPORTATION

4.5.1 Background

Meeting the challenges of increased marine travel and trade within the Gulf of St. Lawrence requires a comprehensive understanding of commercial vessel activity, as well as activities associated with marine ports. The high volume of vessel traffic within the Gulf of St. Lawrence raises many potential concerns related to marine safety; vessel traffic management; port security, marine environmental, wildlife and ecosystem protection; illegal activities; and ocean activity conflicts. This chapter is intended to provide a brief overview of commercial shipping activity within the Gulf of St. Lawrence and the management tools put in place to regulate vessel traffic.

4.5.2 Administrative Authorities

Transport Canada and the Canadian Coast Guard take the lead role in regulating and managing marine traffic within Canadian waters. Environment Canada, Canada Customs, Department of National Defence, Transportation Safety Board of Canada, Canadian Transportation Agency, National Search and Rescue Secretariat, Canadian Marine Advisory Council, and the Atlantic Pilotage Authority and Laurentian Pilotage Authority also play significant roles in the management of marine vessel activity within Atlantic Canada. As described in Appendix I, acts and regulations facilitating marine vessel activity in Canadian waters include the Canada Marine Act, Canada Shipping Act and Regulations, Canadian Transportation Accident Investigation and Safety Board Act and Regulations, Coasting Trade Act, Marine Transportation Security Act, Navigable Waters Protection Act and Regulations, Pilotage Act and Regulations, and Transportation of Dangerous Goods Act and Regulations.

4.5.3 Vessel Traffic Overview

The Gulf of St. Lawrence and the St. Lawrence Seaway is a major marine corridor that opens central (Great Lakes) and eastern Canada to the international trade market. The Cabot Strait, the major point of entry to the Gulf of St. Lawrence, accommodates approximately 6,400 commercial vessel transits annually (Coffen-Smout et al. 2001). The Strait of Belle Isle provides a seasonal (June to January) vessel route for marine trade with European countries.

Canadian ports handled 385.6 million tons (Mt) of cargo in 1999, loading 179.6 Mt of foreign bound cargo. United States was the major destination for foreign bound cargo with 32.8 Mt shipped to

Atlantic ports, 18.3 Mt to Great Lake ports, and 8.6 Mt to Pacific ports. Major commodities transported throughout the Gulf of St. Lawrence by large cargo vessels include crude petroleum and other petroleum products; metallic and non-metallic ore and ore by-products; chemicals; newsprint, pulp and other forest by-products; coal and coke; agricultural products (mainly corn, wheat and feed), and miscellaneous cargo (Statistics Canada 2001). Other vessel traffic includes passenger/vehicle/commercial ferries, tugs and barges, cruise ships, private yachts, and fishing vessels. A number of major commercial ferry routes exist throughout the Gulf of St. Lawrence including North Sydney (Nova Scotia) to Port aux Basques (Newfoundland and Labrador); St. Barbe (Newfoundland and Labrador) to Blanc Sablon (Quebec); Caribou (Nova Scotia) to Wood Islands (Prince Edward Island); Souris (Prince Edward Island) to Cap aux Meules (Îles-de-la-Madeleine, Quebec); and within Quebec: Baie-Comeau to Matane; and Sept-Îles to Rimouski and Port Menier (Anticosti Island). Coastal ferries service a number of ports along the Quebec North Shore.

Figure 4-21 provides an overview of inbound tanker and cargo traffic destined for Atlantic Canada ports during 2000. The arrow width represents vessel counts in the shipping corridor (traffic density); the color indicates the countries and continents of origin. Major ports are represented by a specified number of inbound transects.

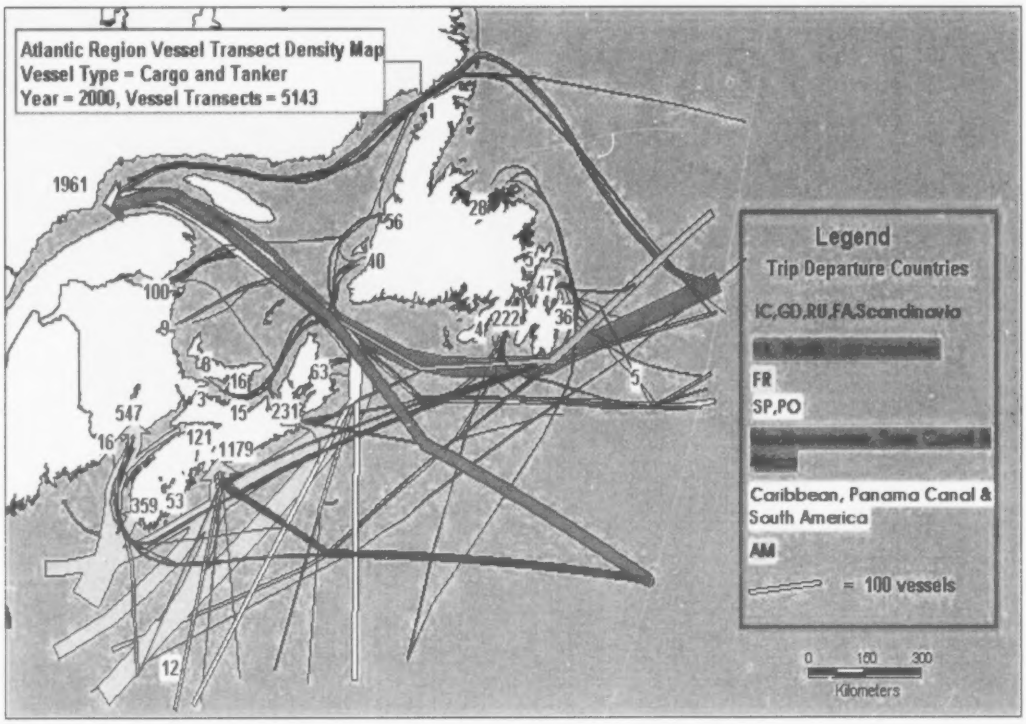

Figure 4-21 Atlantic inbound vessel transect density map: Inbound cargo and tanker shipments during 2000. Courtesy of Geocentric Mapping Consulting. 2002.

4.5.4 Vessel Traffic Services Zones

The Marine Communications and Traffic Services (MCTS) section of the Canadian Coast Guard provides the initial response to commercial vessels entering Canadian waters. MCTS ensures safe marine navigation through communicating and coordinating distress calls; vessel screening to prevent the entry of unsafe vessels; regulating marine vessel traffic movement; facilitating ship – shore

Atlantic ports, 18.3 Mt to Great Lake ports, and 8.6 Mt to Pacific ports. Major commodities transported throughout the Gulf of St. Lawrence by large cargo vessels include crude petroleum and other petroleum products; metallic and non-metallic ore and ore by-products; chemicals; newsprint, pulp and other forest by-products; coal and coke; agricultural products (mainly corn, wheat and feed); and miscellaneous cargo (Statistics Canada 2001). Other vessel traffic includes passenger vehicle commercial ferries, tugs and barges, cruise ships, private yachts, and fishing vessels. A number of major commercial ferry routes exist throughout the Gulf of St. Lawrence including North Sydney (Nova Scotia) to Port aux Basques (Newfoundland and Labrador); St. Barbe (Newfoundland and Labrador) to Blanc Sablon (Quebec); Caribou (Nova Scotia) to Wood Islands (Prince Edward Island); Souris (Prince Edward Island) to Cap aux Meules (Iles-de-la-Madeleine, Quebec); and within Quebec: Baie-Comeau to Matane, and Sept-Iles to Rimouski) and Port Menier (Anticosti Island). Coastal ferries service a number of ports along the Quebec North Shore.

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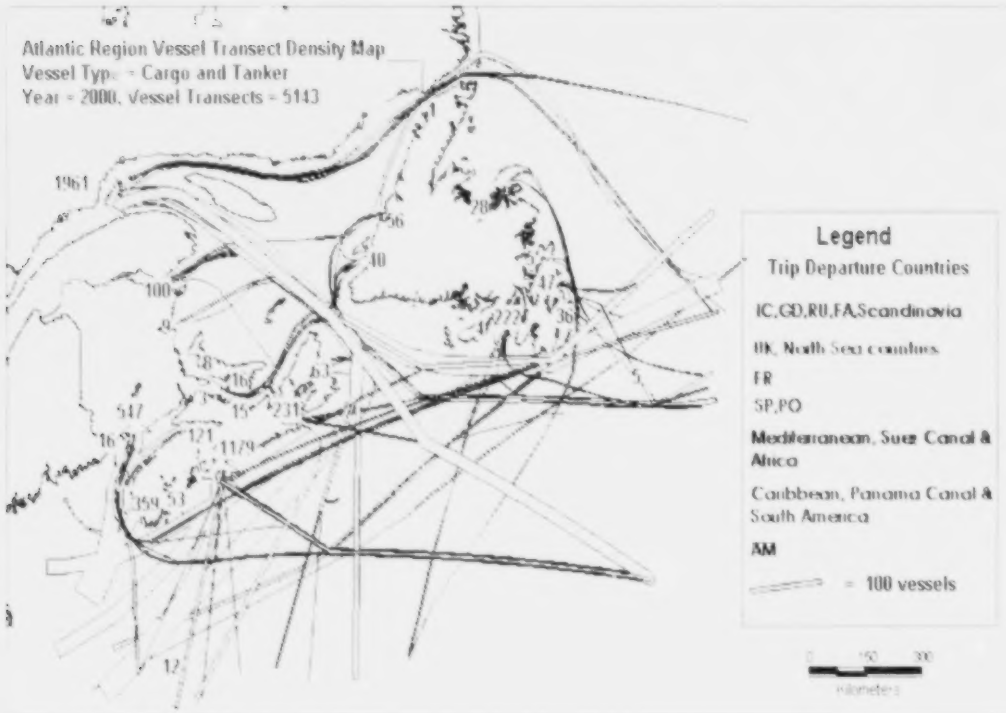

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4.5.4 Vessel Traffic Services Zones

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communications; and managing an Integrated Marine Information System in support of economic benefits and national interests (DFO 2005a). All of these functions are derived from a regulatory framework based primarily on the Canada Shipping Act (CSA) and the International Maritime Organization (IMO) Convention for Safety of Life at Sea (SOLAS). The 1989 amendments to the Canada Shipping Act and accompanying regulations (Eastern Canada Vessel Traffic Services Zone Regulations; Vessel Traffic Services Zones Regulations) allow for the establishment of vessel traffic services (VTS) zones and mandatory vessel traffic practices and procedures within those zones. In response to this amendment, a number of regional and Local VTS Zones were established to facilitate commercial vessel movement within the Gulf of St. Lawrence (Figure 4-22; Table 4-17) and other Canadian waters. A VTS Zone is a geographical marine area in which vessels of a specified size reports to a Canadian Coast Guard MCTS Centre at predetermined points within the zone. VTS Zones allow for safe and efficient movement of vessel traffic while protecting the environment through traffic management.

Vessel Traffic Service Zones and Traffic Lanes in the Gulf of St. Lawrence
Legend
Vessel Traffic Service Zone
Vessel Traffic Lane
Strait of Belle Isle VTS Zone
St. Lawrence Waterway VTS Zone
Port aux Basques VTS Zone
Northumberland Strait VTS Zone
kilometres

Figure 4-22 Vessel traffic services (VTS) zones in the Gulf of St. Lawrence and estuary. Data courtesy of Canadian Coast Guard. 2003.

Table 4-17 Vessel traffic service (VTS) zones in the Gulf of St. Lawrence and estuary.

Vessel Traffic Service Zone	Description
Eastern Canada Vessel Traffic Services Zone	Eastern Canada VTS Zone consists of Canadian waters on the east coast of Canada, south of the sixtieth parallel of north latitude; and east of 66° 00' west longitude in the St. Lawrence River (Eastern Canada Vessel Traffic Services Zone Regulations); excluding waters within Ungava Bay and the Local VTS Zones (Northumberland Strait VTS Zone; Port aux Basques VTS Zone; St. Lawrence Waterway VTS Zone; and Strait of Belle Isle VTS Zone) referred to in the Vessel Traffic Services Zone Regulations (Figure 2).
Northumberland Strait VTS Zone	The Northumberland Strait VTS Zone (Figure 3) includes all waters of the Northumberland Strait extending west from a line drawn between Cape Cliff, NS, (45°52'42"N, 63°28'00"W) to Rice Point, PEI; (46°07'48"N, 63°13'18"W), to a line drawn between Fagan Point, NB; (46°13'42"N, 64°13'44"W), to Cape Egmont Light, PEI, (46°24'06"N, 64°08'06"W).
Port aux Basques VTS Zone	The Port aux Basques VTS Zone (Figure 4) extends from Cape Ray, (47°37'17"N, 59°18'16".8W), in a direction 232° True to the limits of Canadian waters; thence along the Canadian Territorial Sea boundary, to position (47°23'36"N, 58°41'30"W); thence 000° True to Rose Blanche point Light, (47°35'57"N, 58°41'30"W).
St. Lawrence Waterway VTS Zone	The St. Lawrence Waterway VTS Zone (Figure 5) comprises the waters of the St. Lawrence River extending upstream from the meridian of longitude 66°00'00" W to the upper limits of Montreal Harbour; including the Saguenay River and other tributary rivers where vessels enter or leave the St. Lawrence River between the above limits; but excluding that portion of the St. Lawrence Seaway from St. Lambert lock to a position 650 metres downstream from the section of Jacques-Cartier bridge spanning the Seaway.
Strait of Belle Isle VTS (Voluntary) Zone	The Strait of Belle Isle Vessel Traffic Services (Voluntary) Zone (Figure 6) is comprised of all waters within the Strait of Belle Isle encompassed by a line bearing 142.5° True from Double Island, Labrador (52° 15' 30"N, 55° 33' 00''W), to Northeast Ledge, Belle Isle (52° 02' 15"N, 55° 16' 00"W); thence a line bearing 186.5° True to White Islands, Newfoundland (51° 35' 12"N 55° 21' 00W); thence a line bearing 265° True to Partridge Pt. Light, Newfoundland (51° 34' 53"N, 55° 25' 20"W); thence following the south shore of the Strait of Belle Isle to Seal Island, Newfoundland (51° 17' 20" N, 56° 45' 48"W); thence a straight line to Forteau Light, Labrador (51° 27' 56"N, 56° 57' 19"W); and thence following the north shore of the Strait of Belle Isle to Double Island, Labrador (52° 15' 30"N, 55° 33' 00''W). Vessels required to comply with the Vessel Traffic Services Zones Regulations are requested to participate in the system.

4.5.5 Ports

Ports throughout the Gulf of St. Lawrence not only support domestic and international trade and travel, but also the socio-economic well-being of coastal communities and industries associated with those ports (Figure 4-23). The majority of ports in the Gulf of St. Lawrence support resource based industries such as mining, forestry, fishing, agriculture, and petroleum. Pulp and paper mills and mineral processing operations are strategically located adjacent to major ports servicing domestic and international trade markets. Tables 4-18 through 4-22 identify major ports within the Gulf of St. Lawrence and their associated functions.

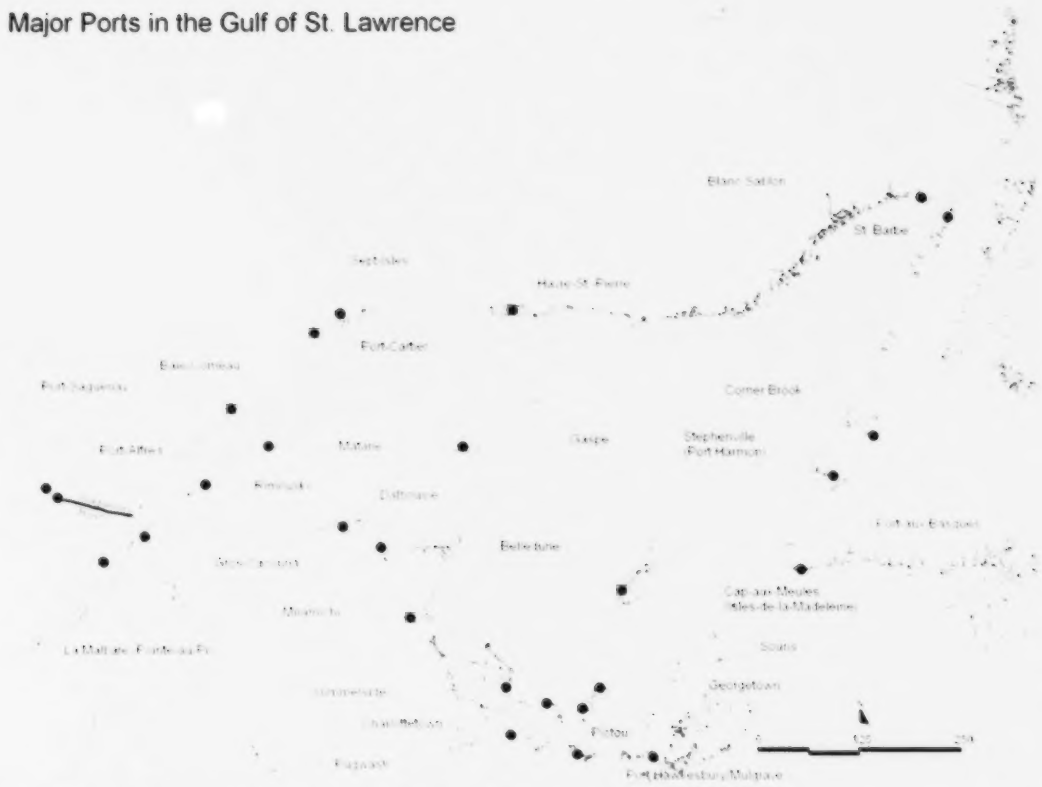

Figure 4-23 Major ports along the Gulf of St. Lawrence.

A number of ports along Newfoundland and Labrador (Port aux Basques, St. Barbe), Prince Edward Island (Chalottetown, Souris), Îles-de-la-Madeleine (Cap-aux-Muelles), and the Quebec north shore (Blanc Sablon, Harve-St-Pierre) provide a vital link to mainland Canada (Figure 4-23). Several smaller ports along the Quebec north shore, Anticosti Island, Îles-de-la-Madeleine, Prince Edward Island and northern Newfoundland and Labrador operate on a seasonal basis, either due to heavy ice conditions or the seasonal requirements of industries associated with the ports (Table 4-23). The ports of Baie-Comeau and Port-Cartier handle transhipments of grain destined for transatlantic crossings. Port Hawkesbury/Mulgrave is one of the busiest ports in Canada, mostly due to its location and potential to handle transhipments of petroleum products. The port serves as a transition area for large ocean going petroleum tankers and smaller tankers entering the St. Lawrence River and Great Lakes system.

Table 4-18 New Brunswick ports along the Gulf of St. Lawrence.[28]

Port	Major Functions	Traffic
Dalhousie	Shipping of paper from local mills	paper carriers
Belledune	Shipping of lead and zinc products from the local smelter; accommodates incoming shipments of coal; major marine service center for northern NB	Bulk mineral carriers; cargo ships
Miramichi	Shipping of paper products from the local pulp and paper mill	Paper carriers

Table 4-19 Newfoundland and Labrador ports along the Gulf of St. Lawrence.[28]

Port	Major Functions	Traffic
Port aux Basques (located at the outer limits of the Gulf of St. Lawrence along the Cabot Strait)	Accommodates the Marine Atlantic Terminal, providing a year round marine trade link between Newfoundland and Labrador and Nova Scotia	Two passenger/vehicle ferries and a cargo ferry
Stephenville (Port Harmon)	Shipping of newsprint from the local mill prior to the mill closing in 2005.	Paper carriers, barges
Corner Brook	Major marine trade center for western NL; shipping of newsprint from the local mill, three petroleum tank farms, incoming shipments of gypsum to the local gypsum processing plant (closed in 2006); container ship service to Halifax; proposed commercial ferry service to Belledune, NB	Paper carriers, container ships, petroleum tankers, cruise ships, bulk mineral carriers, barges
St. Barbe	Accommodates a seasonal marine ferry service to Blanc Sablon, QC and southern Labrador	Passenger/vehicle/cargo ferry

Table 4-20 Nova Scotia ports along the Gulf of St. Lawrence. 28

Port	Major Functions	Traffic
Pugwash	Shipping of salt from the local mine	Bulk mineral carriers
Pictou	Base for the Canadian Coast Guard Inshore Rescue Unit; private and public marinas	Pleasure crafts; cruise ships; coast guard rescue craft
Port Hawkesbury/ Mulgrave	Shipping of paper, petroleum and gypsum; transition area for ocean going and smaller petroleum tankers	Petroleum tankers, paper carriers, bulk mineral carriers

Table 4-21 Prince Edward Island ports. 28

Port	Major Functions	Traffic
Summerside	Export of agricultural products; accommodates incoming shipments of cargo	Cargo ships
Charlottetown	Export of agricultural products; accommodates incoming shipments of cargo; accommodates the cruise ship industry	Cargo ships; cruise ships
Georgetown	This port operates on a seasonal basis; domestic shipping of cargo; fishing port	Cargo ships; fishing vessels
Souris	This port operates on a seasonal basis; domestic shipping of cargo; accommodates an interprovincial passenger/vehicle ferry service to the Magdelan Islands; fishing port	Passenger/vehicle ferry; cargo ship; fishing vessels

28 Transport Canada (Atlantic) http://www.tc.gc.ca/eng/atlantic/menu.htm (Accessed 2005).

Table 4-22 Quebec Ports along the Gulf of St. Lawrence and estuary.[29]

Port	Major Functions	Traffic
Blanc Sablon	Accommodates a seasonal marine ferry service to other ports along the Quebec north shore and St. Barbe, NL	Passenger/vehicle/cargo ferries
Harve-St-Pierre	Shipping of titanium and iron ore from local mines; accommodates a coastal passenger/cargo ferry service along the Quebec north shore; fishing ports	Bulk mineral carriers; coastal passenger/cargo ferry; local fishing boats
Sept-Îles	Shipping of iron ore from northern Quebec mines; accommodates a passenger/cargo ferry service to isolated ports along the Quebec north shore; fishing port	Bulk mineral carriers; coastal passenger/cargo ferry; local fishing boats
Port-Cartier	Shipping of iron ore from northern Quebec mines; handles transshipments of grain from central Canada	Bulk mineral and grain carriers
Baie-Comeau	Shipping of aluminum, and paper from the local aluminum smelter and nearby pulp and paper mills; transhipments of grain from central Canada; rail-ferry and passenger/vehicle ferry link to Matane, QC	Paper carriers; bulk mineral and grain carriers; rail ferry; passenger/vehicle ferry
Port-Saguenay	Shipping of paper from local pulp and paper mills; shipping of granite form local mines	Paper carriers; bulk mineral carriers
Port-Alfred	Shipping of aluminum from local smelters	Bulk mineral carriers
La Malbaie (Pointe-au-Pic)	Shipping of paper from local pulp and paper mill	Paper carriers
Gros-Cacouna	Shipping of paper and other wood products; shipping of salt	Paper carriers; bulk carriers
Rimouski	Shipping of petroleum products to local petroleum storage farms; shipping of forest products from local mills; accommodates a passenger/cargo ferry service to Sept-Îles and isolated ports along the Quebec north shore; passenger/vehicle ferry service to Forestville, QC	Petroleum tankers; bulk wood carriers; coastal passenger/cargo ferry; passenger/vehicle ferry
Matane	Shipping of paper and other forest products from local mills; rail-ferry and a passenger vehicle service to Baie-Comeau	Paper carriers; rail ferry; passenger/vehicle ferry
Gaspé	Shipping of petroleum products to local petroleum storage farms ; shipping of general cargo	Petroleum tankers; cargo ferry
Cap-aux-Meules (Iles-de-la-Madeleine)	Accommodates a seasonal passenger/vehicle/cargo ferry service to Prince Edward Island; shipping of salt from local mine	Passenger/vehicle/cargo ferry; bulk mineral carrier

29 Transport Canada (Quebec Region): List of Ports http://www.tc.gc.ca/eng/quebec/ports-menu-1338.htm (Accessed 2005).

Table 4-23 Ports operating on a seasonal basis along the Gulf of St. Lawrence and estuary.

Port	Province	Major Functions	Traffic
St. Barbe	Newfoundland and Labrador	Seasonal passenger/vehicle/cargo ferry service to Blanc Sablon, Quebec	Passenger/ vehicle/cargo ferry
Blanc Sablon	Quebec	Accommodates a seasonal passenger/cargo ferry service to other ports along the Quebec north shore and a passenger/vehicle/cargo ferry service to St. Barbe, Newfoundland and Labrador	Passenger/ vehicle/cargo ferries
St-Augstine	Quebec	Accommodates a coastal passenger/cargo ferry	Passenger/cargo ferry
La Tabatière	Quebec	Accommodates a coastal passenger/cargo ferry	Passenger/cargo ferry
Tête-à-la-Baleine	Quebec	Accommodates a coastal passenger/cargo ferry	Passenger/cargo ferry
Harrington Harbour	Quebec	Accommodates a coastal passenger/cargo ferry	Passenger/cargo ferry
La Romaine	Quebec	Accommodates a coastal passenger/cargo ferry	Passenger/cargo ferry
Kegaska	Quebec	Accommodates a coastal passenger/cargo ferry	Passenger/cargo ferry
Natashquan	Quebec	Accommodates a coastal passenger/cargo ferry	Passenger/cargo ferry
Port-Meunier (Anticosti Island)	Quebec	Accommodates a coastal passenger/cargo ferry service	Passenger/cargo ferry
Cap-aux-Meules	Quebec	Accommodates a seasonal passenger/vehicle/cargo ferry service to Prince Edward Island; shipping of salt from local mine	Passenger/ vehicle/cargo ferry; bulk mineral carriers
Rivière-du-Loup	Quebec	Accommodate seasonal passenger vehicle ferry service	Passenger/ vehicle/cargo ferry
Woods Island	Prince Edward Island	Accommodates a commercial passenger/vehicle service to Caribou, Nova Scotia	Passenger/ vehicle/cargo ferry
Souris	Prince Edward Island	This port operates on a seasonal basis; domestic shipping of cargo; fishing port	Cargo ships; fishing vessels
Georgetown	Prince Edward Island	This port operates on a seasonal basis; domestic shipping of cargo; accommodates an interprovincial passenger/vehicle ferry service to Cap-aux-Meules (Iles-de-la-Madeleine); fishing port	Passenger/ vehicle ferry; cargo ship; fishing vessels
Caribou	Nova Scotia	Accommodates a commercial passenger/vehicle to Woods Island, Prince Edward Island	Passenger/ vehicle/cargo ferry

Fisheries and Oceans Canada, Small Craft Harbours Branch operates and maintains a national system of harbours that provide commercial fish harvesters and recreational boaters with safe and accessible port facilities. The Small Craft Harbours Branch obtains its authority from the Fishing and Recreational Harbours Act and Regulations, and the Federal Real Property Act. In recent years, the

branch has transferred management responsibilities for many harbours to local harbour authorities (Fisheries and Oceans Canada 2005*b*).

4.5.6 Pilotage Areas

There are nine established compulsory pilotage areas[30] throughout the Gulf of St. Lawrence, three of which are further divided into zones: Cape Breton Compulsory Pilotage Area; Restigouche Compulsory Pilotage Area; and the St. Lawrence River Compulsory Pilotage Area (Figure 4-24; Table 4-24); (Atlantic Pilotage Authority Regulations). Compulsory pilotage areas are established to facilitate the safe movement of commercial vessel traffic within selected ports which have some degree of difficulty and hazard in the approaches and within the port itself. Other criteria taken into account for the establishment of compulsory pilotage areas include the amount of vessel movement and manoeuvrability; size of vessels; design of wharves, slips, and actual space available for manoeuvring; nature of cargo carried on board (e.g. oil, gas, explosives, hazardous materials); and environmental concerns and the preservation of the ecosystem.

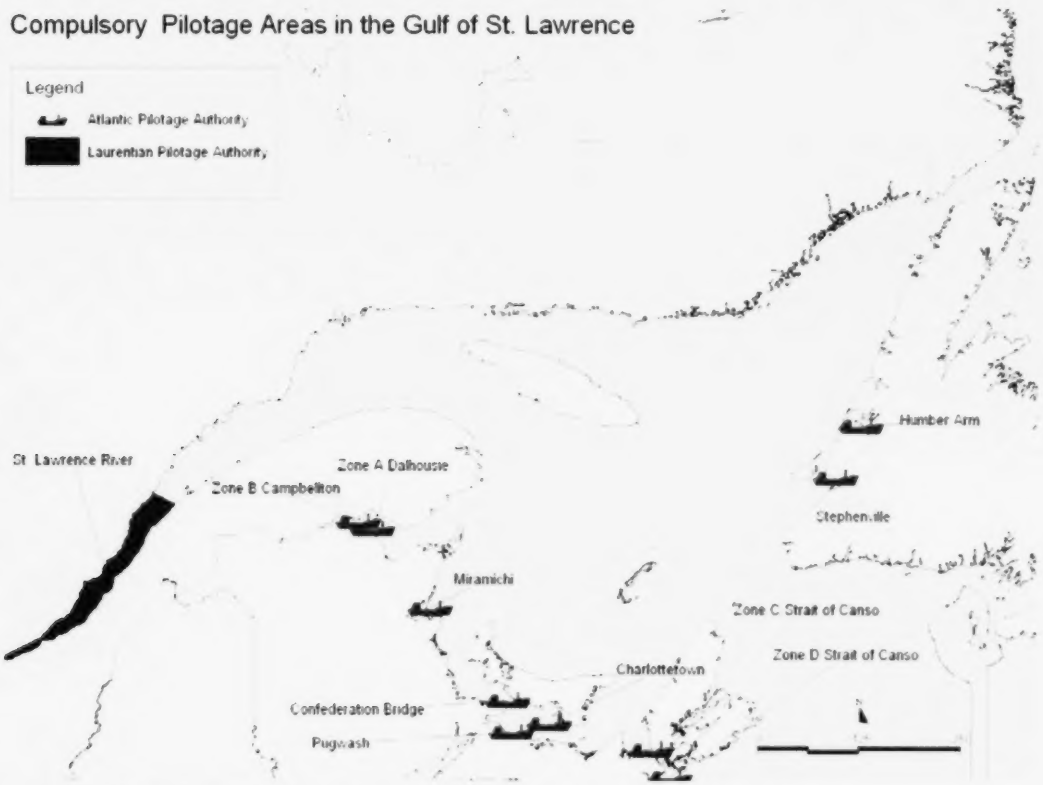

Figure 4-24 Compulsory pilotage areas within the Gulf of St. Lawrence and estuary.

The Atlantic Pilotage Authority and Laurentian Pilotage Authority are responsible for pilotage activity in the Gulf of St. Lawrence and St. Lawrence River respectively, receiving their authority from the Pilotage Act[31] and accompanying regulations:

- Atlantic Pilotage Authority Regulations;

30 Atlantic Pilotage Authority Regulations http://laws.justice.gc.ca/en/C-R.C.-c.1264/ ; Laurentian Pilotage Authority Regulations http://lois.justice.gc.ca/en/P-14/C.R.C.-c.1268/index.html (Accessed 2005).

31 Pilotage Act (R.S., 1985, C. P-14) http://laws.justice.gc.ca/en/P-14/index.html (Accessed 2005).

- Atlantic Pilotage Authority Non-compulsory Area Regulations;
- Atlantic Pilotage Tariff Regulations (1996);
- Atlantic Pilotage Tariff Regulations–Newfoundland and Labrador Non-compulsory Areas;
- Laurentian Pilotage Authority Regulations;
- Laurentian Pilotage Authority District No. 3 Regulations; and
- Laurentian Pilotage Tariff Regulations).

The Pilotage Act also allows for the provision of non-compulsory pilotage,[32] where a vessel may request the assistance of the Atlantic Pilotage Authority or Laurentian Pilotage Authority in areas under their respective jurisdictions, other than the established compulsory pilotage areas.

Table 4-24 Compulsory pilotage areas within the Gulf of St. Lawrence and estuary.

Pilotage Area	Description
Humber Arm Compulsory Pilotage Area (Newfoundland and Labrador)	The Humber Arm compulsory pilotage area consists of all the navigable waters east of a line drawn from Frenchman's Head to McIver Point within the Bay of Islands (Atlantic Pilotage Authority Regulations).
Stephenville Compulsory Pilotage Area (Newfoundland and Labrador)	The Stephenville compulsory pilotage area consists of all the navigable waters in Stephenville Pond (Port Harmon) and all the navigable waters within a line drawn from Indian Head Light in a direction of 210° (True) for a distance of 600 m, thence 320° (True) for a distance of 900 m, thence 030° (True) for a distance of 820 m to shore (Atlantic Pilotage Authority Regulations).
Cape Breton Compulsory Pilotage Area (Nova Scotia)	The Cape Breton compulsory pilotage area is composed of four zones, two of which are relative to the Gulf of St. Lawrence: Zone C Strait of Canso, which consists of all the navigable waters within a line drawn from Red Head to Crichton Island Light and a line drawn from North Canso Light to Heffernan Point; and Zone D Strait of Canso, which consists of all the navigable waters within a line drawn from Fox Island to Green Island in Chedabucto Bay and a line drawn from Red Head to Crichton Island Light (Atlantic Pilotage Authority Regulations).
Pugwash Compulsory Pilotage Area (Nova Scotia)	The Pugwash compulsory pilotage area consists of all the navigable waters within a line drawn from Pugwash Point to a geographic point situated at a distance of 2.1 nautical miles on a bearing of 025° (True), thence, for a distance of 2.2 nautical miles on a bearing of 270° (True), and thence, on a bearing of 205° (True) to Lewis Head (Atlantic Pilotage Authority Regulations).
Miramichi Compulsory Pilotage Area (New Brunswick)	The Miramichi compulsory pilotage area consists of all the navigable waters within a line drawn from Pointe Morin to the north end of Portage Island, thence, on a bearing of 114° (True) to a position at Latitude 47°07'30" N., Longitude 64°47'00" W. and thence, on a bearing of 191° (True) to Point Escuminac Light (Atlantic Pilotage Authority Regulations).
Restigouche Compulsory Pilotage Area (New Brunswick)	The Restigouche compulsory pilotage area is composed of two zones, namely: Zone A Dalhousie which consists of all the navigable waters within a line drawn from Little Belledune Point on a bearing of 000° (True) for a distance of 3.0 nautical miles, and a line drawn from a latter geographical point to Misquasha Point and a line drawn from Peuplier Point to Pointe a Fleurant; and Zone B Campbellton which consists of all the navigable waters within a line drawn

32 Atlantic Pilotage Authority Non-compulsory Area Regulations http://www.tc.gc.ca/media/documents/acts-regulations/sor-86-1084-regulations.pdf ; Laurentian Pilotage Authority District No. 3 Regulations http://www.tc.gc.ca/media/documents/acts-regulations/sor-87-58-regulations.pdf

Pilotage Area	Description
	from Peuplier Point to Pointe a Fleurant and a line drawn from Prait Point to Point de la Mission (Atlantic Pilotage Authority Regulations).
Charlottetown Compulsory Pilotage Area (Prince Edward Island)	The Charlottetown compulsory pilotage area consists of all the navigable waters within a line drawn from Rice Point to a geographic point situated at a distance of 7.9 nautical miles on a bearing of 180° (True), thence, for a distance of 7.7 nautical miles on a bearing of 090° (True), and thence, on a bearing of 000° (True) to Prim Point (Atlantic Pilotage Authority Regulations).
Confederation Bridge Compulsory Pilotage Area (Prince Edward Island)	The Confederation Bridge compulsory pilotage area consists of all the navigable waters within a quadrilateral commencing at a point at Latitude 46°11'00" N, Longitude 63°47'00" W, thence on a bearing of 340° (True) for a distance of 4.4 nautical miles to a position at Latitude 46°15'12" N, Longitude 63°49'12" W, thence on a bearing of 107° (True) for a distance of 4.1 nautical miles to a position at Latitude 46°14'00" N, Longitude 63°43'30" W, thence on a bearing of 157° (True) for a distance of 3.75 nautical miles to a position at Latitude 46°10'30" N, Longitude 63°41'30" W, thence on a bearing of 277° (True) for a distance of 3.9 nautical miles to the point of commencement (Atlantic Pilotage Authority Regulations).
St. Lawrence River Compulsory Pilotage Areas (Quebec)	The compulsory pilotage area within the St. Lawrence River consists of the following waters: all the navigable waters of the St. Lawrence River between the northern entrance to St. Lambert Lock and a line bearing 121°(True) and drawn across the said River at Latitude 48°20'48" N., Longitude 69°23'24" W.; all the navigable waters lying within the limits of any harbour situated within the area referred to in the above statement notwithstanding that the limits of any such harbour may extend into waters not considered part of the St. Lawrence River; and all the navigable waters of the Saguenay River to the western limits of Baie des Ha Ha and the Harbour of Chicoutimi. The compulsory pilotage area is further divided into the following districts: District No. 1--All waters between the northern entrance to St. Lambert Lock and a line drawn across the St. Lawrence River at Longitude 71°08'W. District No. 1-1--All waters between the northern entrance to St. Lambert Lock and a line running east and west across the St. Lawrence River at the northernmost tip of île Ste-Thérèse. District No. 2--All waters between a line drawn across the St. Lawrence River at Longitude 71°20'W. and a line bearing 121° (True) and drawn across the St. Lawrence River at Latitude 48°20'48"N., Longitude 69°23'24"W., including the Saguenay River. District No. 3--All waters of the region of the Authority not included within the limits of District No. 1, District No. 1-1 and District No. 2 (Laurentian Pilotage Authority Regulations).

Table 4-25 Pilotage assignments within the Gulf of St. Lawrence and estuary compulsory pilotage areas during 2002.

Compulsory Pilotage Area	Authority	Pilotage Assignments (2002)
Stephenville	Atlantic Pilotage Authority	115
Humber Arm	Atlantic Pilotage Authority	312
St. Lawrence River	Laurentian Pilotage Authority	19,149
Restigouche (Zone A and B)	Atlantic Pilotage Authority	108
Miramichi	Atlantic Pilotage Authority	7
Pugwash	Atlantic Pilotage Authority	84
Cape Breton (Zone C and D)	Atlantic Pilotage Authority	906
Charlottetown	Atlantic Pilotage Authority	126
Confederation Bridge	Atlantic Pilotage Authority	74
Total Pilotage Assignments (2002)		20,881

Source: Statistics Canada 2002.

4.5.7 Summary

The marine transportation industry is the backbone of the Canadian economy, linking most other industries to domestic and international markets. Additionally, the cruise ship industry has increased throughout the Gulf of St. Lawrence in recent years. A number of concerns associated with the marine transportation industry include the release of contaminants into the marine environment, introduction of alien and potentially invasive species, ocean security, and potential conflicts with other ocean activities. The release of wastewater, bilge water and ballast water contribute to the release of contaminants in the marine environment. Modern cruise ships accommodate approximately 4,000 passengers and crew, and are estimated to produce 100 gallons of wastewater per person per day (Klein 2003). Bilge water contains contaminants generated from engines and other mechanical components of a ship. Ballast water is used to stabilize ships during voyage and later discharged at other ports. Shipping moves 80% of the commodities, and transfers approximately 10 million tonnes of ballast water internationally each year. Ballast water is considered as one of the major sources of introducing invasive species and potentially toxic dinoflagellate spores (responsible for causing harmful algal blooms); (Terdalkar 2005). Secondary transport of invasive species (Miimi 2004) is also a major concern as domestic vessel traffic frequent ports throughout the Gulf of St. Lawrence. Ballast Water and Marine Pollution Regulations are currently under development to replace existing voluntary guidelines.

4.5.8 Information Gaps

One discussion that may be added to this section is the distribution of fishing and recreational harbours. Fishing and recreational harbours cater to domestic marine traffic (mainly commercial fishing and small recreational boats) throughout the Gulf of St. Lawrence. While major shipping lanes are well documented, more research is needed to identify coastal shipping lanes and the impact marine traffic may have on these coastal and marine areas.

4.6 COASTAL AND MARINE TOURISM AND RECREATION

4.6.1 Background

Coastal and marine tourism and recreation is an industry that is experiencing phenomenal growth throughout the Gulf of St. Lawrence, and becoming a significant contributor to the economy throughout the area. This trend appears to correspond and reflect the growth of the industry on a national and global scale which is forecasted to become one of the world's largest industries by the year 2015.

A network of national, provincial, municipal and private parks and historic sites as well as a number of conservation areas exist throughout the Gulf of St. Lawrence. These areas conserve and protect a number of significant ecological and cultural areas, but at the same time many of these areas attract large numbers of people. A wide variety of activities associated with these significant areas and other coastal and marine areas include cruise ship activity, offshore excursions and tours, recreational boating, kayaking, golf course development, cottage/cabin development, coastal hiking, swimming and camping.

The following sections provide a brief description of major attractions and activities within the coastal and marine areas of the Gulf of St. Lawrence.

4.6.2 Attractions and Activities

National Parks and Historic Sites: Parks Canada Agency protects a number of significant natural and cultural areas around the Gulf of St. Lawrence through the creation of national parks and historic sites. Six national parks and seven national historic sites border the Gulf of St. Lawrence (Table 4-26), two of which are world heritage sites (Gros Morne National Park and L'Anse Aux Meadow National Historic Site). Appendix IV lists national parks and historic sites bordering the Gulf of St. Lawrence (Parks Canada 2005).

Table 4-26 National parks and historic sites bordering the Gulf of St. Lawrence by province.

Province	National Park	National Marine Park	National Historic Site
Newfoundland and Labrador*	1	0	3
Quebec	2	1	3
New Brunswick	1	0	1
Nova Scotia	1	0	0
Prince Edward Island	1	0	0
Total	6	1	7
* Two world heritage sites			

Provincial Parks and Historic Sites: Provincial parks and historic sites range from camping areas to public beaches and day use areas. In Quebec, provincial parks are referred to as Quebec national parks. Provincial governments are the administrative authorities for their respective provincial parks and historic sites. There are approximately 59 provincial parks and at least four provincial historic sites bordering the Gulf of St. Lawrence (Table 4-27), one of which is a world heritage site (Miguasha (Quebec national) Park and World Heritage Site). Appendix V lists provincial parks and historic sites bordering the Gulf of St. Lawrence.

Table 4-27 Provincial parks and historic sites bordering the Gulf of St. Lawrence by province.

Province	Provincial Park	Provincial Historic Site
Newfoundland and Labrador[33]	6	3
Quebec*[34]	5	0
New Brunswick[35]	3	1
Nova Scotia[36]	17	0
Prince Edward Island[37]	28	0
Total	59	4
*One world heritage site		

Municipal and Private Parks: There are numerous municipal and private parks distributed along the Gulf of St. Lawrence, ranging from day use to RV parks and beach areas. These parks are often located near national and provincial tourist areas.

Conservation and Protected Areas: Conservation and protected areas account for more than 10,000 km² of marine and coastal area within the Gulf of St. Lawrence. These areas include both national (migratory bird sanctuaries, wildlife areas, heritage rivers) and provincial (ecological reserves, natural/wildlife/wilderness areas) designated areas (Figure 4-25; Table 4-28). Basin Head off eastern Prince Edward Island is the first marine protected area implemented under the Oceans Act within the Gulf of St. Lawrence, with two others proposed (The St. Lawrence estuary and Manicougan Peninsula). Conservation and protected areas along the Gulf of St. Lawrence are administered at a number of levels including national, provincial and corporate. Appendix VI lists conservation and protected areas relevant to the Gulf of St. Lawrence.

33 Government of Newfoundland and Labrador. Environment and Conservation http://www.env.gov.nl.ca/parks

34 Sépaq, la Société des établissements de plein air du Québec http://www.sepaq.com/index-en.html

35 Government of New Brunswick,The Official Tourism Website of the province of New Brunswick http://www.tourismnewbrunswick.ca/en-ca

36 Government of Nova Scotia, Natural Resources. Nova Scotia's Provincial parks http://parks.gov.ns.ca

37 Government of Prince Edward Island. Info PEI http://www.gov.pe.ca/visitorsguide/index.php3?number=1010978

Figure 4-25 Conservation and protected areas bordering the Gulf of St. Lawrence.

Table 4-28 Conservation and protected areas bordering the Gulf of St. Lawrence by province.

Province	Ecological Reserve[38]	Natural/ Wildlife/ Wilderness Areas[39]	Migratory Bird Sanctuaries[40]	National Wildlife Areas[41]	Canadian Heritage River[42]	Total
Newfoundland and Labrador	3	0	0	0		3
Quebec	6		19	5		30
New Brunswick	0	4	1	2		7
Nova Scotia	0	4	0	2	1	7
Prince Edward Island	0	0	1	0		1
Total	9	8	21	9	1	48

Golf Courses: Golf course development in recent years has experienced phenomenal growth and is often located along coastlines and major watershed areas. At least 40 golf courses border the Gulf of St. Lawrence.

38 Government of Newfoundland and Labrador, Environment and Conservation http://www.env.gov.nl.ca/parks ; Government of Quebec, Department of Environment and Parks http://www.mddep.gouv.qc.ca/ministere/mtet_en.htm#services

39 Government of Nova Scotia, Wilderness Areas – Wilderness Area Protection Act http://www.gov.ns.ca/legislature/legs/statutes/wildarea.htm

40 Environment Canada, Canadian Wildlife Service (Quebec Region), Migratory Bird Santuaries http://www.qc.ec.gc.ca/faune/faune/html/mbs.html ; Migratory Bird Sanctuary Regulations http://laws.justice.gc.ca/en/M-7.01/C.R.C.-c.1036/

41 Environment Canada, Canadian Wildlife Service (Quebec Region), National Wildlife Areas http://www.qc.ec.gc.ca/faune/faune/html/nwa.html, Environment Canada (Atlantic Region) http://www.atl.ec.gc.ca/wildlife/index.html

42 The Canadian Heritage Rivers System http://www.chrs.ca/

Cruise and Marine Excursion Industry: The cruise sector is the world's fastest growing sector of the leisure travel industry, with new cruise ships accommodating up to 4,000 passengers and crew. This increase in the cruise sector is also reflected in the eastern Canadian market including the Gulf of St. Lawrence. In recent years, cruise lines have been looking for new destinations as a result of overcrowding in Alaskan waters and the threat of war in the Mediterranean region.

In 2003, Canadian ports saw more than 880 cruise ship calls, generating 1.55 million passenger arrivals. Pacific ports accommodated 73% of passenger traffic with Atlantic Canada (led by Halifax), and Quebec (led by Montreal and Quebec City) ports accommodating 21% and 6% of passenger traffic respectively. In Canada, direct spending by the cruise industry (cruise ships, passengers and crew) for 2003 totalled $965 million with Atlantic Canada and Quebec generating $67.5 million and $71.3 million respectively (Business Research and Economic Advisors 2004).

In the Gulf of St. Lawrence, there are basically two markets: Canada/New England and European. The Canada/New England market is dominated by round trips from Boston and New York with fewer trips directly connecting these two U.S. cities and Montreal. European cruises often include Atlantic Canada and Quebec ports within their trans-Atlantic itineraries. Ships from as many as 20 cruise lines frequent ports throughout the Gulf of St. Lawrence; (Atlantic Canada Cruise Association 2005).

Cruise ships generate several types of waste including black water, grey water, garbage and solid waste, hazardous waste, bilge water; ballast water and diesel exhaust emissions (Table 4-29). A typical cruise ship produces 100 gallons of waste water and 3.5 kilograms of solid waste per passenger per day. Cruise ships entering the Gulf of St. Lawrence can accommodate anywhere from five hundred to four thousand passengers and crew. The estimated production of bilge water for a typical cruise ship is seven thousand gallons per day, while each release of ballast water can reach one thousand metric tons. The production and release of bilge and ballast water not only applies to the cruise ships, but all large vessels.

Legislation regarding the discharge of waste from cruise ships varies as much as the waste itself. There is no Canadian legislation controlling the discharge of black and grey wastewater, although the Government of Canada is working with the cruise ship industry to create a Memorandum of Understanding that would contain environmental guidelines for the operation of cruise ships in coastal waters of Canada. Meanwhile, international law prohibits the discharge of black water within a 12 mile limit. The lack of monitoring for compliance under such laws and agreements, and limited penalties associated with violations may do little to deter cruise ship companies from breaking these laws and agreements (Klein 2003).

Table 4-29 Typical sources of waste from cruise ships and other large vessels.[43]

Waste	Description	Discharge
Black water	Discharge from toilets	10 gallons per passenger per day
Grey water	Discharge from sinks, showers, spas, beauty parlours	90 gallons per passenger per day
Garbage and solid waste	Garbage and solid waste	3.5 k per passenger per day
Hazardous waste	Dry cleaning sludge, photofinishing chemicals, paint waste and solvents, print shop waste, fluorescent lamps and batteries	15 gallons per day
Bilge water	Wastewater from engine including fuel, oil, metal shavings and cleaning agents	7,000 gallons per day
Ballast water	Use to stabilise a ship and offset the weight of fuel consumption	Approximately 1,000 metric tonnes
Exhaust emissions	Diesel exhaust	Equivalent to 12,240 automobiles

The marine excursion sector also plays a significant role in the marine and coastal tourism and recreation industry. Marine excursions are often associated with national parks, reserves and conservation areas and include whale and bird watching tours, fishing excursions, and scenic coastal tours. This sector occurs throughout much of the Gulf of St. Lawrence, but is probably more centralized in Quebec along the estuary and the North Shore. In 2001, these areas of Quebec had 108 boats operating in the marine excursion sector; approximately half were located along the North Shore. The majority of Quebec's marine excursion sector is geared towards the whale watching industry (Pêches et Océans Canada 2003).

Recreational Boating: Recreational boating is another sector that is experiencing phenomenal growth, with Canadians owning approximately two million recreational boats. This sector includes sailboats, cabin cruisers, powerboats, personal water crafts and human powered boats such as canoes and kayaks (Industry Canada 2005). The National Recreational Boating Advisory Council (NRBAC) advises Transport Canada on safety and environmental issues related to the recreational boating industry and represents regional advisory councils in Quebec, the Maritimes, and Newfoundland and Labrador (Transport Canada 2005*c*). Recreational boating occurs throughout much of the inshore areas of the Gulf of St. Lawrence. Maritime Quebec alone accounts for some 60,000 powerboats, 12,000 sailboats and 15,000 manually operated boats (canoes, kayaks and other rowboats); (Environment Canada 2004*a*). Unfortunately, this data is not readily available for the Atlantic provinces.

Recreational boating has the potential to adversely impact the marine environment in a number of ways. In the mid 1990s, research was conducted in selected marine areas of the Gulf of St. Lawrence (Cardigan and Summerside, Prince Edward Island; Pictou, Nova Scotia; Miramichi and Shediac, New Brunswick) that were frequented by commercial and recreational vessels. The research consisted of seasonal testing for butyltins tributyltin[44] (TBT) and dibutyltin (DBT) in sediments and wild blue mussel populations. Results of the research showed that Shediac and Summerside was the most contaminated, suggesting that recreational boating appear to be the main source of contamination (St-Jean et al. 1999). Recreational boating activity in areas that are frequented by whales and seabird

43 Klein, R. A. March 2003. Cruising – Out of Control: The Cruise Industry, The Environment, Workers, and the Maritimes. P. 27 http://www.policyalternatives.ca/documents/Nova_Scotia_Pubs/NS_cruising.pdf (Accessed 2005).

44 Antifouling paints containing tributyltin are applied as a finish coat to the immersed sections of boats and floating structures. As the paint releases tributyltin into the water, it creates an environment that repels the organisms that may attach to the surface of the submerged object. http://www.atsdr.cdc.gov/toxprofiles/tp55-c6.pdf

colonies may affect the behaviour of these species as well as other marine species. Meanwhile, there is potential for conflict with other marine activities if not properly managed.

Other Recreational Activities: A number of other recreational activities taking place along the Gulf of St. Lawrence include cottage/cabin development, waterfowl hunting, swimming, scuba diving, camping, and coastal hiking. In the past, cottage/cabin development along coastal areas (especially in secluded areas) was probably associated with the commercial fishing industry. Fish harvesters would reside in these areas during the fishing season and move back to their permanent residence during the winter. Cottage/cabin development is an activity that has increased in recent years with urban and retiring populations identifying coastal environments as a great place to spend their leisure time. Swimming, camping and hiking commonly occur along coastal and marine areas and are probably more highly concentrated within and near publicized areas such as national, provincial and municipal parks.

4.6.3 Summary

The coastal and marine tourism and recreation industry in the Gulf of St. Lawrence is a diverse and growing industry. Increased growth in this industry has the potential to adversely impact the coastal and marine environment and conflict with one another if not managed properly.

In recent years, the cruise ship activity has increased in the Gulf of St. Lawrence, which results in increased potential to release contaminants into marine areas through the discharge of wastewater and bilge water. Bilge water discharge is blamed for an annual loss of 300,000 seabirds along Canada's Atlantic coast (Klein 2003). An increase in ballast water discharge also increases the potential of introducing foreign and invasive species. Many of these species have an adverse effect on native species through predation and competition for habitat. An increase in cruise ship and other vessel activity within sensitive areas may also place stress on populations of whales, other marine mammals and seabirds which frequent these areas to breed and feed.

A major concern associated with cottage development is the disposal of waste. In general, new developments must abide by the respective provincial regulations for waste disposal. Past developments may be more of a concern, especially in remote areas where regulations may have not been in place at that time or regulations may have been ignored altogether.

National, provincial and municipal parks often place restrictions on the number of people that can access an area at one time, but large numbers of visitors over a longer period may still be a concern, especially within sensitive areas. While these activities may have a minimal impact on the coastal and marine environment, an increase in any activity also increases the potential to adversely affect the environment and conflict with other resource users.

The phenomenal growth of this industry is exerting increasing pressures on some of the most fragile coastal and marine environments and its inhabitants. At the same time, this industry also depends upon continued maintenance of sustainable, clean and healthy environments to further expand the industry and attract tourists. It is in the best interest of the industry that all stakeholders contribute to an ocean management process that will ensure the Gulf of St. Lawrence remains a sustainable and healthy environment.

4.7 LAND BASED ACTIVITIES

4.7.1 Background

Land-based activities have the potential to adversely affect the ecological state of the Gulf of St. Lawrence. It has been estimated that nearly 80% of marine debris likely originates from land-based sources, washed directly into waterways or arriving through a combination of storm sewer and sewage outfalls (Coe 1996). Sources of effluent include municipal wastewater (through residential and commercial sewers and storm sewers), and industrial effluent (pulp and paper mills, mineral processing operations, food processing plants, and agriculture and mining activities).

4.7.2 Municipal Wastewater

Municipal wastewater (sewage and grey water[45]) is one of the largest sources of marine pollution by volume. Residential areas, public facilities, business establishments, and industries all use water in every day operations. Wastewater becomes polluted by the introduction of organic and inorganic matter. A great deal of the domestic and industrial wastewater is discharged either raw or with some level of treatment into the coastal waters, bays and estuaries of the Gulf of St. Lawrence. Under ideal circumstances, micro-organisms break down the organic matter into beneficial nutrients. However, with more than 800,000 people living along the Gulf of St. Lawrence, and millions of people residing near watershed areas (i.e. Upper St. Lawrence River) flowing into the Gulf of St. Lawrence, the volumes of discharge are greater than what receiving waters can often assimilate. As a result, problems arise in sheltered harbours and inlets where tidal flushing or ocean currents are less effective in dispersing effluents. This wastewater is a complex mix of floating debris, petroleum based products, particulate organic matter (POM), dissolved organic matter (DOM), dissolved inorganic matter (DIM), viruses, bacteria and heavy metals (Coe 1996). All of these substances can work to degrade and impact on ecological aspects of coastal and marine environments within the Gulf of St. Lawrence.

There are a number of pieces of legislation regulating the implementation of municipal wastewater disposal and treatment facilities, and the discharge of municipal wastewater (Table 4-30). Environment Canada administers a number of federal acts and regulations related to the disposal of contaminants within the marine environment. The implementation of wastewater disposal and treatment systems is regulated at the provincial level (Canadian Council of Ministers of the Environment 2004). A number of municipalities have bylaws that control the disposal of specific substances through municipal wastewater systems. In 1996, the provinces of Newfoundland and Labrador, Nova Scotia, New Brunswick and Prince Edward Island, with the assistance of Environment Canada, developed a consolidated wastewater treatment manual to address discharge standards, operator training requirements, sewage treatment plant classifications, exchange of information on innovative technologies and performance standards (Environment Canada 2000). In 2003, the Canadian Council of Ministers of the Environment (CCME) including federal, provincial and territorial Ministers gathered to discuss the development of a Canada-wide strategy for municipal wastewater effluent; an approach that would see harmonization of federal, provincial, territorial and municipal wastewater management processes. The Canada-wide strategy for the management of wastewater effluent was scheduled to be developed by November 2006 (Canadian Council of Ministers of the Environment 2004).

45 Grey water is wastewater other than sewage; wasterwater that is used during cleaning processes that is released down sinks and showers.

Table 4-30 Legislation addressing the disposal of municipal wastewater.

Authority	Act	Regulations
Quebec	Environment Quality Act	• Regulation Respecting Waterworks and Sewage Services • Regulation Respecting Wastewater Disposal Systems for Isolated Dwellings
New Brunswick	Clean Environment Act Clean Water Act	• Water Quality Regulation • Fees for Industrial Approvals Regulation
Prince Edward Island	Environmental Protection Act	• Water Wells Regulations • Sewage Disposal Regulations • Atlantic Canada Standards and Guidelines Manual for Collection, Treatment and Disposal of Sanitary Sewage
Nova Scotia	Environment Act	• Water and Wastewater Facility Regulations • Activities Designation Regulations • On-site Sewage Disposal Regulations • On-site Services Advisory Board Regulations
Newfoundland and Labrador	Water Resources Act	
Government of Canada	Fisheries Act Canadian Environmental Protection Act Canadian Environmental Assessment Act	

The collection of data to describe municipal wastewater effluent discharge from communities adjacent to the Gulf of St. Lawrence has proven to be quite challenging and tedious. Each province has different means of monitoring wastewater discharge and recording the distribution of wastewater treatment throughout the five provinces bordering the Gulf of St. Lawrence. The Atlas of Canada provides a schematic showing the distribution of population without wastewater treatment throughout these five provinces (Figure 4-26).

insufficient data

< 25% Approximate GSL Coastal Areas include Prince Edward Island, New Brunswick (Bathurst to Moncton) Nova Scotia (Coastal Areas of Cumberland, Colchester and Pictou Counties) and Newfoundland (Mid Northern Peninsula Communities)

25% - 50% Approximate GSL Coastal Areas include most of the Gaspe Peninsula

50% - 75% Approximate GSL Coastal Areas include Bay of Chaleur

75% - 100% Approximate GSL Coastal Areas include Newfoundland (Rocky Harbor to Channel Port aux Basques) and (Pistolet Bay to Plum Point), Nova Scotia (Antigonish County and Inverness and Victoria Counties of Cape Breton Island)

Figure 4-26 Distribution of Gulf of St. Lawrence population without wastewater treatment facilities. (Natural Resources Canada 2004).

Newfoundland and Labrador: Western Newfoundland and southern Labrador have a population of approximately 66,000 distributed throughout more than 50 communities. Data was only available for the island portion of the province, with western Newfoundland data divided into three regions: Bay St. George, Northern Peninsula West, and Bay of Islands. The population of western Newfoundland is approximately 59,000, with 89% utilizing municipal wastewater systems (Table 4-31). Only 17% of

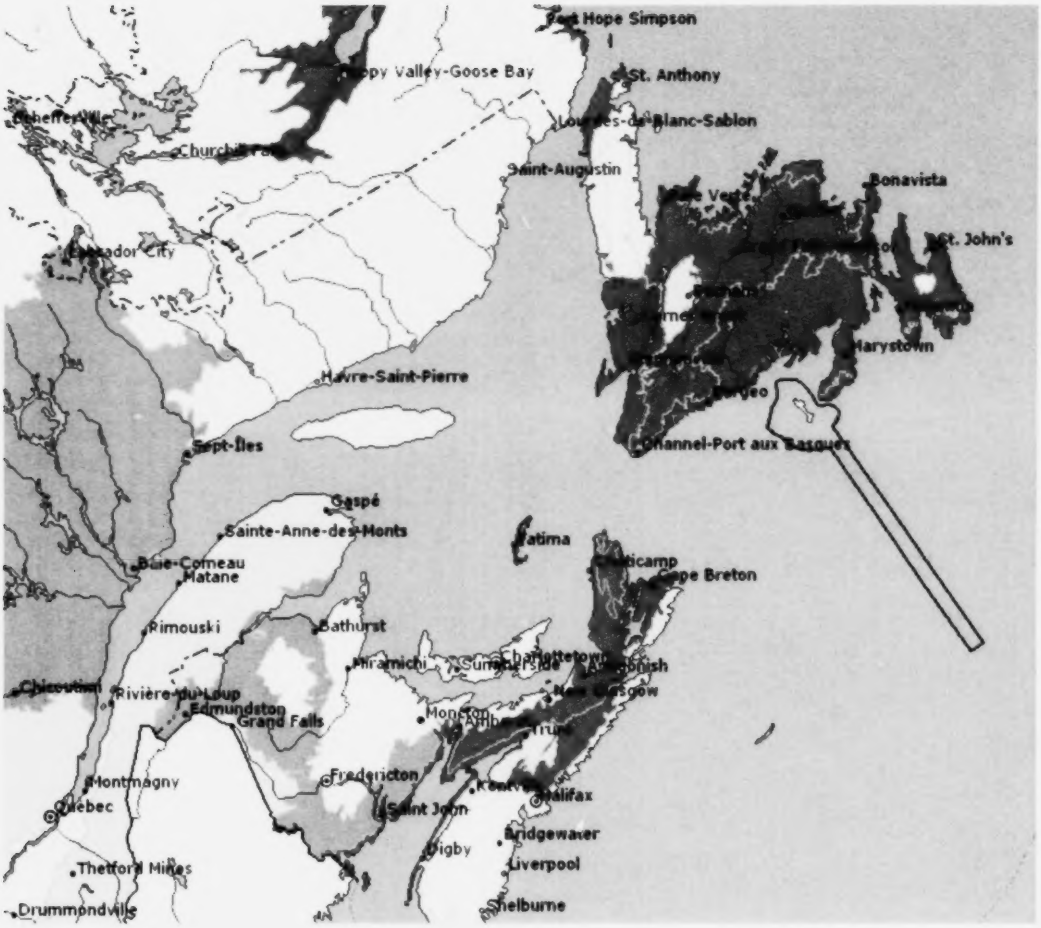

Figure 4-26 Distribution of Gulf of St. Lawrence population without wastewater treatment facilities. (Natural Resources Canada 2004).

Newfoundland and Labrador: Western Newfoundland and southern Labrador have a population of approximately 66,000 distributed throughout more than 50 communities. Data was only available for the island portion of the province, with western Newfoundland data divided into three regions: Bay St. George, Northern Peninsula West, and Bay of Islands. The population of western Newfoundland is approximately 59,000, with 89% utilizing municipal wastewater systems (Table 4-31). Only 17% of

the population utilizing municipal wastewater systems is accommodated with wastewater treatment. Three of the larger communities, Deer Lake, Pasadena and Steady Brook, have secondary wastewater treatment. The city of Corner Brook and Stephenville discharge untreated wastewater directly into the marine environment. Stephenville currently has a pilot project in place to implement wastewater treatment. Corner Brook has recently completed a water and sewage treatment plan to implement similar wastewater treatment measures. The other 11% of the population along western Newfoundland utilize private septic systems or discharge raw wastewater directly into the environment. It is estimated that only 28% of the population throughout western Newfoundland have access to wastewater treatment (Table 4-31). Wastewater treatment processes consist mainly of aerated lagoons.

Table 4-31 Western Newfoundland populations utilizing municipal and private wastewater systems and wastewater treatment facilities (2001).

Region	GSL Region Population	Municipal System	Private System	No Wastewater Treatment	Primary Treatment	Secondary Treatment	Tertiary Treatment
Bay St. George	11,826	11,746 (99.3%)	80 (0.7%)	11,746 (99.3%)	0	0	0
Northern Peninsula West	9,476	6,170 (65%)	3,306 (35%)	6,170 (65%)	0	0	0
Bay of Islands	37,984	34,902 (92%)	3,082 (8%)	24,760 (68%)	1,029	9,113	0
Western Newfoundland Total	59286	52818 (89%)	6468 (11%)	42676 (72%)	1029 (1.7%)	9113 (15.3%)	0

New Brunswick: In New Brunswick, the counties of Glouchester, Kent, Northumberland, Restigouche, and Westmorland border the Gulf of St. Lawrence. These five counties have approximately 170 communities, with a combined population of approximately 326,000 (Table 4-32). Approximately 66% of the population utilize municipal wastewater systems and the remaining 34% utilizing private septic systems or directly release wastewater into the environment. Approximately 88% of the population has access to some form of wastewater treatment. For the most part, secondary treatment consists of aerated lagoons and oxidation ditches, while tertiary treatment consists primarily of the addition of gas and ultra-violet light. Private septic systems primarily consist of engineered septic tanks with septic fields, and/or individual outfalls in particular for homes that are located close to the shoreline.

Table 4-32 New Brunswick populations utilizing municipal and private wastewater systems and wastewater treatment facilities (2001).

Region	GSL Region Population	Municipal System	Private System	No Wastewater Treatment	Primary Treatment	Secondary Treatment	Tertiary Treatment
Glouchester	82,929	45,842 (55.3%)	37,087 (44.7%)	11,912 (26%)		33,930 (74%)	11,050
Kent	31,383	5,699 (18.2%)	25,684 (81.8%)	149		5,550 (96.5%)	4,250
Northumberland	50,817	23,423 (46%)	27,394 (54%)	4,123 (17.6%)		19,300 (82.4%)	11,150
Restigouche	36,134	24,003 (66.4%)	12,131 (33.6%)			24,003 (100%)	9,750
Westmorland	124,688	115,033 (92%)	9,655 (8%)	22,248 (19.3%)	74,500 (80.3%)	18,285 (19.7%)	6,200
Eastern New Brunswick Total	325,951	214,000 (65.6%)	111,951 (34.3%)	38,432 (11.8%)	74,500 (22.9%)	101,068 (31%)	42,400 (13%)

Prince Edward Island: The population of Prince Edward Island is approximately 135,000. Based on information from Natural Resources Canada (Figure 4-26), approximately 75% of the population of Prince Edward Island avails of wastewater treatment. Presently, there are 29 communities served by central wastewater treatment plants. Prince Edward Island is now in an enviable position in that its entire municipal population is serviced by wastewater treatment of one form or another (Government of Prince Edward Island 2004*b*).

Nova Scotia: In Nova Scotia, the counties of Colchester, Cumberland, Pictou, Antigonish or Inverness are located adjacent to the Gulf of St. Lawrence. These counties have a combined population of 170,000. Approximately 75% of the coastal population within the counties of Colchester, Cumberland and Pictou has some form of wastewater treatment. As for Antigonish and Inverness, less than 25% of the population have wastewater treatment facilities (Figure 4-26); (Natural Resources Canada 2004*b*).

Quebec: In Quebec, data was provided for the coastal areas of five economic regions: Gaspésie - Îles-de-la-Madeleine; Bas-St-Laurent/Chaudière-Appalache; Capitale-Nationale; Saguenay-Lac-St-Jean and Côte-Nord (Michel Laurin et Jean-Pierre Beaumont. Direction des infrastructures, Ministère des Affaires municipales, du Sport et du Loisir. Gouvernment du Quebec. "pers. comm." 2004). These coastal areas encompass 125 municipalities with a total population of 515,325. In the last few years, Quebec's municipal wastewater systems have benefited from major improvements, with the construction of new wastewater treatment facilities within municipalities where wastewater treatment did not previously exist (Government of Quebec 2004). Currently, 39% of municipalities (75% of population) within these coastal areas have wastewater collection with treatment facilities (Table 4-33; Table 4-34). Ten percent (10%) of municipalities (3% of population) still discharge their collected wastewater directly into the aquatic environment and 12% (4% of population) only screen their wastewater, which is almost equivalent to no treatment at all, since screening does not reduce organic matter, suspended solids and bacteria contents. In addition, 28% of coastal municipalities (16% of population) utilize private septic systems or otherwise release wastewater directly into the environment. Saguenay-Lac-St-Jean represents the largest population with wastewater collection and treatment facilities (87%) and Gaspésie-Îles-de-la-Madeleine with the lowest at 56%. It is also interesting to note that of the 26 wastewater-screening plants present in the entire province of Quebec, 20 of them are located along the Gulf of St. Lawrence and estuary and dump their effluent into the marine environment. Half of these are located in the coastal portion of the Côte-Nord region. Wastewater treatment processes consist of screening, aerated lagoons, activated sludge and rotating biological reactors. Municipalities discharging untreated wastewater into the marine environment are spread out all along Quebec's coastline. Surprisingly, in addition to municipalities without a wastewater treatment facility, some of those with a treatment facility also dump untreated wastewater into the environment. Indeed, in several instances, part of their wastewater collection system is simply not connected to a treatment facility and is instead dumped directly into the environment.

Table 4-33 Number and percentage of municipalities according to type of wastewater system for the coastal portions of the five economic regions of Québec bordering the Gulf of St. Lawrence.

Type of wastewater disposal system	Gaspésie - Îles-de-la-Madeleine	Bas-St-Laurent + Chaudière-Appalaches	Capitale-Nationale	Saguenay-Lac-St-Jean	Côte-Nord	Total – Coastal Quebec
No Wastewater system	12 *(32 %)*	11 *(31 %)*	1 *(13 %)*	2 *(25 %)*	9 *(25 %)*	35 *(28 %)*
Wastewater collection, but no treatment	2 *(5 %)*	4 *(11 %)*	2 *(25 %)*	0 *(0 %)*	5 *(14 %)*	13 *(10 %)*
Wastewater collection, but only screening	3 *(8 %)*	1 *(3 %)*	1 *(13 %)*	2 *(25 %)*	8 *(22 %)*	15 *(12 %)*
Wastewater collection and mix of screening and treatment	1 *(3 %)*	0 *(0 %)*	1 *(13 %)*	0 *(0 %)*	1 *(3 %)*	3 *(2 %)*
Wastewater collection and treatment	18 *(49 %)*	18 *(50 %)*	3 *(38 %)*	3 *(38 %)*	7 *(19 %)*	49 *(39 %)*
Unknown system	1 *(3 %)*	2 *(6 %)*	0 *(0 %)*	1 *(13 %)*	6 *(17 %)*	10 *(8 %)*
Total	37 *(100 %)*	36 *(100 %)*	8 *(100 %)*	8 *(100 %)*	36 *(100 %)*	125 *(100 %)*

Table 4-34 Population according to type of wastewater system for the coastal portions of the five economic regions of Québec bordering the Gulf of St. Lawrence. (Courtesy of Quebec Ministry of Municipal Affairs, Sports and Recreation, 2003)

Type of sewer system	Gaspésie - Îles-de-la-Madeleine	Bas-St-Laurent + Chaudière-Appalaches	Capitale-Nationale	Saguenay-Lac-St-Jean	Côte-Nord	Total – Coastal Quebec
No wastewater system	26 921 *(29 %)*	22 313 *(15 %)*	5 517 *(24 %)*	17 027 *(11 %)*	11 709 *(12 %)*	83 487 *(16 %)*
Wastewater collection, but no treatment	3 998 *(4 %)*	3 625 *(3 %)*	2 644 *(12 %)*	500 *(0.3 %)*	4 505 *(5 %)*	15 272 *(3 %)*
Wastewater collection, but only screening	8 347 *(9 %)*	1 250 *(1 %)*	900 *(4 %)*	1 736 *(1 %)*	8 453 *(9 %)*	20 686 *(4 %)*
Wastewater collection and treatment	52 248 *(56 %)*	116 291 *(80 %)*	13 458 *(60 %)*	138 988 *(87 %)*	64 513 *(67 %)*	385 498 *(75 %)*
Unknown system	2 023 *(2 %)*	1 068 *(1 %)*	0 *(0 %)*	735 *(0.5 %)*	6 556 *(7 %)*	10 382 *(2 %)*
Total	93 537 *(100 %)*	144 547 *(100 %)*	22 519 *(100 %)*	158 986 *(100 %)*	95 736 *(100 %)*	515 325 *(100 %)*

Source: Québec Ministry of Municipal Affairs, Sports and Recreation 2003.

Summary: Approximately 88% of the population along eastern New Brunswick; 75% along coastal Quebec, Prince Edward Island and the Nova Scotia North Shore (25% along Cape Breton) and 25% along western Newfoundland have access to some form of wastewater treatment. It is believed that there may be a number of municipalities along the Gulf of St. Lawrence that have wastewater treatment facilities installed, but still dump untreated wastewater into the marine environment. Many of these cases may be the result of lack of funding to complete installation or operate the facility. Within many municipalities, wastewater is only treated at a primary level prior to discharge within the environment, which is much less efficient than secondary (i.e. aerated lagoons) or tertiary treatment (i.e. ultra-violet light). Primary levels of wastewater treatment such as screening, only removes large debris and does little to reduce organic matter, suspended solids and bacteria contents. Since such a treatment is almost equivalent to no treatment at all, in Quebec these screening plants are not subject to any environmental standards regarding their effluent. The operation of such inadequate facilities has, in the most part, been "justified" by the important dilution capabilities of the Gulf of St. Lawrence and estuary, compared to other smaller bodies of water (Jean-Pierre Beaumont, Direction des infrastructures, Ministère des Affaires municipales, du Sport et du Loisir. Gouvernment du Quebec "pers. comm." 2004). Seasonal runoff from spring thaw and heavy rainfall, as well as technical problems with treatment facilities contribute to the discharge of municipal wastewater into the Gulf of St. Lawrence and estuary. The accumulation of contaminants through continuous wastewater discharge within the Gulf of St. Lawrence has an adverse impact on marine species (i.e. mollusc populations) and habitat by depleting dissolved oxygen and releasing toxic chemicals within localized areas. Discharge of contaminated wastewater also has an adverse impact on commercial

industries (fisheries and aquaculture), and recreational and tourism areas (beaches) and activities (swimming and diving).

4.7.3 Pulp and Paper Mills

The pulp and paper industry is widely distributed throughout eastern Canada with approximately 80 mills operating within Quebec and the Atlantic provinces. Approximately 22 of those mills border the Gulf of St. Lawrence, St. Lawrence Estuary, the Saguenay River and other connecting watersheds: 14 in Quebec (Table 4-38), four in New Brunswick (Table 4-37), and two in each of Nova Scotia (Table 4-36) and Newfoundland and Labrador (Table 4-35); (Figure 4-27). A number of these mills have experienced temporary or permanent closures in recent years. There are no pulp and paper mills in Prince Edward Island.

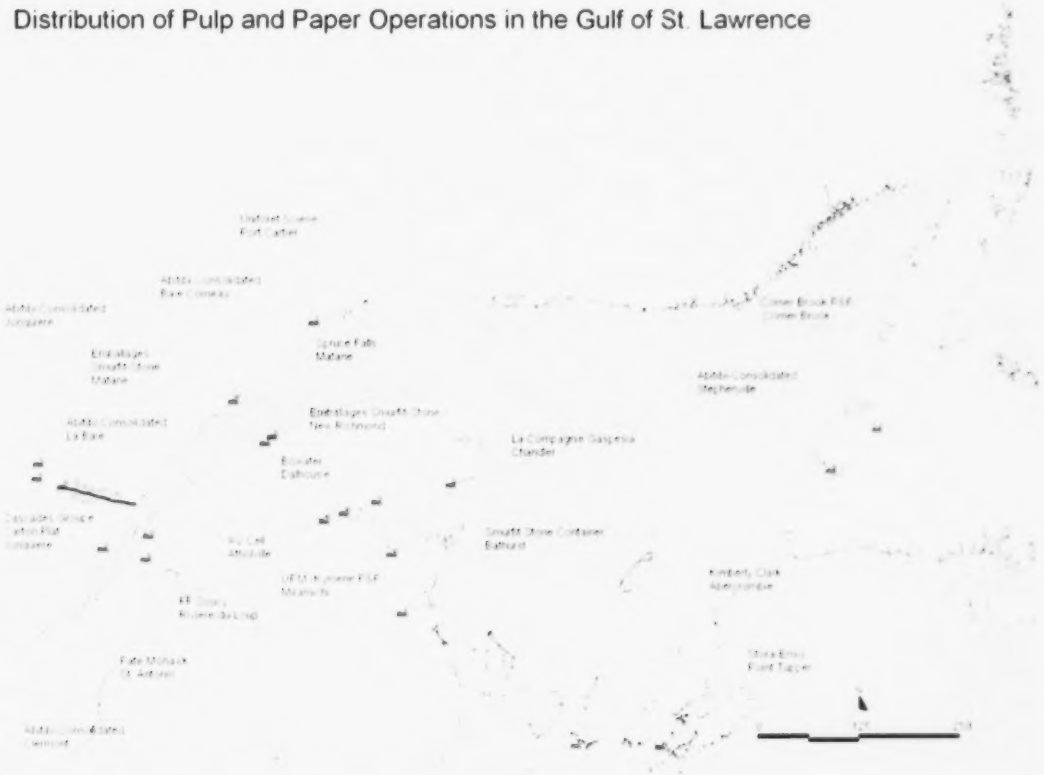

Figure 4-27 Pulp and paper operations along the Gulf of St. Lawrence and estuary.

Newfoundland and Labrador: Two newsprint mills exist along western Newfoundland and Labrador. Corner Brook Pulp and Paper Ltd., a division of Kruger Inc., is located within the Port of Corner Brook, along the Humber Arm of the Bay of Islands (Figure 4-27; Table 4-35). This mill employs 700 people within the mill and its Deer Lake Power (hydroelectric) operations, and another 600 within its woodland operations. Corner Brook Pulp and Paper produces an estimated 1,280 tonnes of newsprint and discharges 84,600 cu meters of effluent daily. Abitibi-Consolidated, Stephenville division is located in Port Harmon along Bay St. George and has been the main employer in the town of Stephenville for a number of years. As of October 2005, Abitibi-Consolidated permanently closed this mill as a part of the company's restructuring program. The Stephenville mill produced an estimated 590 tonnes of newsprint and discharged approximately 18,700 cu meters of effluent daily while in operation (Abitibi Consolidated 2004). Both mills utilize an activated sludge/microbial treatment

process to treat effluent. The Corner Brook operation utilizes solidified sludge, wood waste and Bunker C fuel to fuel boilers (Government of Newfoundland and Labrador 2004*d*).

Table 4-35 Pulp and paper mills along western Newfoundland.

Company (Location)	Product (tonnes/year)	Process	Effluent (m^3/day)	Effluent Treatment	Receiving Water Body
Newfoundland and Labrador					
Abitibi-Consolidated (Stephenville, NL)	Closed	Closed	Closed	Closed	Bay St. George
Corner Brook Pulp and Paper Ltd. (Corner Brook, NL)	Newsprint (430,000)	Thermomechanical	84,600	Activated sludge	Humber Arm

Nova Scotia: In Nova Scotia, the Kimberly-Clark Nova Scotia Ltd. mill is located in Abercrombie and the Stora-Enso mill in Point Tupper (along the Canso Strait) (Figure 4-27). They employ 400 and 660 people respectively. Kimberly-Clark Nova Scotia Ltd. produces sulfate bleached kraft pulp. Stora-Enso produces approximately 500 tonnes of newsprint and 960 tonnes of specialized paper daily. The majority of product from both mills is shipped to the United States. Data regarding effluent discharge and treatment was not available.

Table 4-36 Pulp and paper mills along the Nova Scotia north shore.

Company (Location)	Product (tonnes/year)	Process	Effluent (m^3/day)	Effluent Treatment	Receiving Water Body
Kimberly-Clark Nova Scotia Ltd (Abercrombie, NS)	Pulp (N/A)	Chemical	N/A	N/A	Pictou Harbour
Stora-Enso Mill (Point Tupper, NS)	Newsprint (187,000) Specialty paper (350,000)	Thermomechanical	N/A	N/A	Strait of Canso

New Brunswick: In New Brunswick, four mills exist along the northeastern part of the province: three along Baie des Chaleurs and another along Miramichi River (Table 4-37; Figure 4-27). The Bowater mill in Dalhousie and the UPM-Kymmene mill in Miramichi have an annual newsprint production of approximately 245,000 tonnes and 450,000 tonnes respectively. Meanwhile, both mills received ISO 14001 designation for its efforts to minimize the impact on the environment. AV Cell produces 110,000 tonnes of pulp annually, with the Smurfit-Stone mill in Bathurst producing a number of paper products including kraft liner; white top liner; corrugating medium; and kraft paper.

Table 4-37 Pulp and paper mills along eastern New Brunswick.

Company (Location)	Product (tonnes/year)	Process	Effluent (m^3/day)	Effluent Treatment	Receiving Water Body
AV Cell Inc. (Atholville, NB)	Pulp (110,000)	N/A	N/A	N/A	Baie des Chaleurs
Bowater Dalhousie (Dalhousie, NB)	Newsprint (245,000)	Thermomechanical	N/A	N/A	Baie des Chaleurs
UPM-Kymmene Miramichi Pulp and Paper Inc. (Miramichi, NB)	Newsprint (450,000)	Chemical-mechanical		Activated sludge	Miramichi Bay (via Miramichi River)
Smurfit-Stone Container (Bathurst, NB)	Paperboard (N/A)	N/A	N/A	N/A	Baie des Chaleurs

Québec: Quebec's pulp and paper industry consists of more than 60 mills, accounting for 42 % of the Canadian newsprint production and 10 % of global production (Chabot et al. 2003). At least 14 of these mills border the estuary, Saguenay River and other connecting watersheds, discharging more than 350,000 m^3 of effluent into the marine environment annually (Table 4-38; Figure 4-27). The majority of newsprint operations are thermal-mechanical, with mills producing pulp and specialty papers utilizing a combination of thermal, mechanical and chemical processes. For the most part, effluent is treated through an activated sludge treatment process. In 1993, the International Joint Council designated 11 toxic substances to be tested periodically in areas where wastewater is discharged: PCB's, DDT, dieldrin, toxaphene, dioxins, furans, mirex, mercury, lead alkyl, benzo(a)pyrene and hexachlorobenzene. Tests completed in December 1995 showed that no toxic substance persisted from mills that had introduced a secondary treatment process. In 1995, all mills reported a decrease in wastewater discharge of 20% to 87% from 1988 figures. Many of these changes have taken place since the enactment of the Pulp and Paper Effluent Regulations (1992) and Quebec regulations Respecting Pulp and Paper Mills (St. Lawrence Vision-2000 2004).

Table 4-38 Quebec mills associated with the Gulf of St. Lawrence.

Company (Location)	Product (tonnes/year)	Process	Effluent 1988/ 1995 (m^3/day)	Effluent Treatment	Receiving Water Body
Uniforêt Scierie Pâte inc (Port-Cartier, QC)	Pulp (182,000)	Chemi-thermomechanical	16, 719	Activated sludge	Gulf of St. Lawrence
Abitibi-Consolidated (Baie Comeau, QC)	Newsprint (547,000)	Chemi-thermomechanical	89, 347	Activated sludge	estuary
Abitibi-Consolidated (Alma, QC)	Newsprint (145,000) Specialty paper (110,000)	Thermomechanical Mechanical	75,679/ 50,368	Activated sludge	Saguenay River (via Riviére Petite Décharge)
Abitibi-Consolidated (Jonquière, QC)	Specialty paper (240,000)	Mechanical Thermomechanical	90,058/ 49,253	Activated sludge	Saguenay River
Cascades Groupe Carton Plat inc (Jonquière, QC)	Cardboard (143,500)	Mechanical Chemical	35,678/ 4,568	Activated sludge	Saguenay River (via Riviére aux Sables)
Stone-Consolidated (LaBaie, QC)	Newsprint (445,000)	Thermomechanical Mechanical Chemical	72,058/ 46,688	Activated sludge	Saguenay River
Abitibi-Consolidated (Clermont, QC)	Newsprint (362,000)	Thermomechanical	29, 193	Activated sludge	estuary (via Riviére Malbaie)
Pâte Mohawk Ltée (St. Antonin, QC)	Pulp (1,100)	Mechanical	3, 049	Primary treatment	estuary (via Riviére du Loup)
F.F. Soucy inc. (Rivière-du-Loup, QC)	Newprint (250,000)	Thermomechanical	18,721/ 14,957	Activated sludge	estuary (via Riviére du Loup)
Emballages Smurfit-Stone inc. (Matane, QC)	Cardboard (112,000)	Semi-chemical	6, 543	Primary treatment	estuary
Spruce Falls inc. (Matane, QC)	Pulp (174,000)	Chemi-thermomechanical	16, 730	Activated sludge	estuary
La Compagnie Gaspésia (Chandler, QC)	Closed	Closed	Closed	Closed	Baie des Chaleurs
Emballages Smurfit-Stone inc. (New Richmond, QC)	Closed	Closed	Closed	Closed	Baie des Chaleurs
Abitibi-Consolidated (Beaupré, QC)	Speciality Paper (175,000)	Thermalmechanical	34,431/ 21,607	Activated sludge	estuary

Summary: Since 1992, pulp and paper mills in Canada have been subject to new federal and provincial regulations respecting the release of effluent. These regulations have imposed much stricter standards regarding the discharge of liquid toxic waste. In accordance with the Pulp and Paper Effluent Regulations (Fisheries Act), all pulp and paper mills are required to conduct an Environmental Effect Monitoring (EEM) study every three years to monitor the effects of their effluents on the receiving environment (Walker et al. 2003). Elevated levels of carbon dioxide released within the marine environment from oxygen activated sludge treatment can have an adverse and possible lethal effect on fish species within the immediate area (O'Conner et al. 2000). Testing of tissue from mummichogs (an estuarine fish species) in the Miramichi estuary showed the presence of high levels of chemical contaminants believed to have originated from the local pulp and paper operations within the area (Couillard and Nellis 1999). One would have to question the accumulated effects of toxic wastewater on marine ecosystems prior to the introduction of stricter regulations and wastewater treatment processes.

4.7.4 Mining and Mineral Processing

The mining and mineral processing industry plays a significant economic role throughout Quebec and the Atlantic provinces, contributing approximately $5.6 billion dollars to the Canadian economy in 2002 (Table 8.47); (Natural Resources Canada 2004*a*). This industry is one of a number of resource based industries that dominate the workforce throughout coastal areas of the Gulf of St. Lawrence. Many of these operations are oriented towards raw extraction of minerals, while others focus on secondary processing of refined mineral products. More than 30 mining operations and 13 mineral processing operations have been identified along the Gulf of St. Lawrence or near watersheds flowing into the Gulf of St. Lawrence (Figure 4-28). In addition, an important peat industry exists along the Quebec North Shore, northeastern New Brunswick and Prince Edward Island.

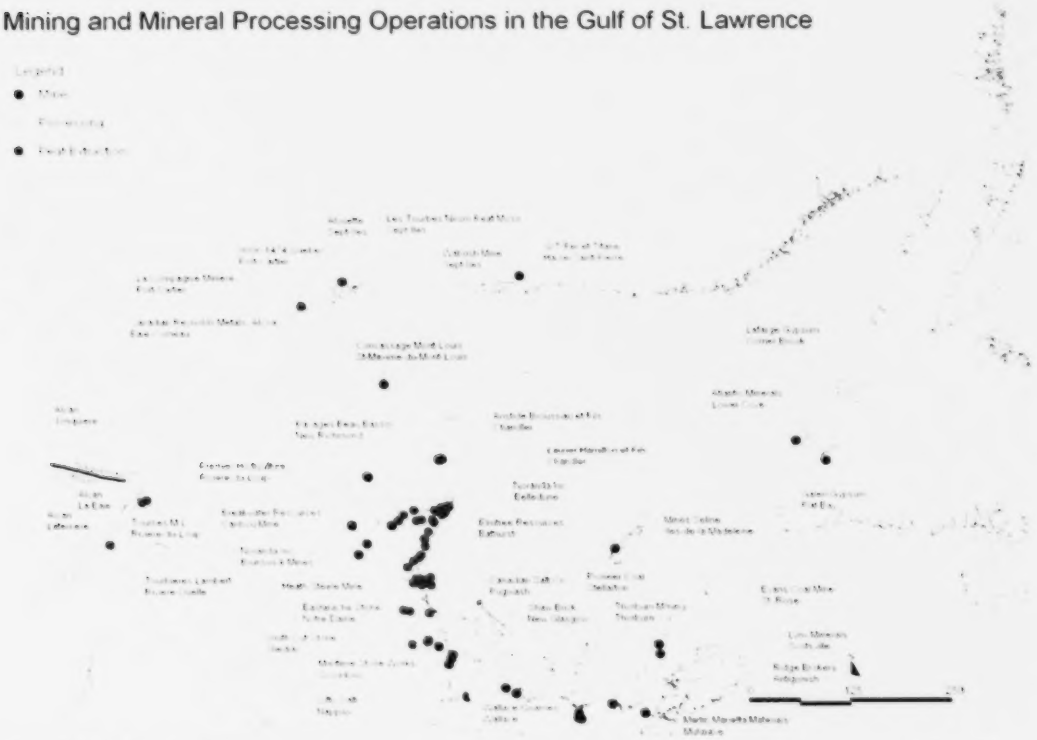

Figure 4-28 Mining and mineral processing operations along the Gulf of St. Lawrence and estuary.

Table 4-39 Economic value of the mining and mineral processing industry of the five provinces bordering the Gulf of St. Lawrence. Economic values presented are for each province as a whole.

Province	Estimated Economic Value (2002)
Newfoundland and Labrador	1,000,000,000
Quebec	3,700,000,000
New Brunswick	652,000,000
Nova Scotia	247,000,000
Prince Edward Island	764,000
Total	5,599,764,000

Source: Natural Resources Canada 2003.

The amendment of the Metal Mining Effluent Regulations (Fisheries Act) in 2002 provides for the assessment of aquatic impacts of effluents from the mining and mineral processing industry. The Environmental Effects Monitoring program provides a biological, effects-based feedback loop to assess the effectiveness of technology based regulations (Walker et al. 2003).

Newfoundland and Labrador: There are three mining and mineral processing operations along western Newfoundland and Labrador (Table 4-40); (Figure 4-28). Atlantic Minerals Ltd. has a limestone/dolomite mining and processing operation in Lower Cove on the south shore of the Port au Port Peninsula. Shipping facilities are located on site. Lafarge Gypsum Canada Inc. is located along the Humber Arm in the Port of Corner Brook. Prior to shutting down operations in 2006, the gypsum plant produced drywall, importing gypsum from the neighbouring Galen Gypsum Mine in Flat Bay as well as out of province locations (Government of Newfoundland and Labrador 2004*c*).

Table 4-40 Newfoundland and Labrador mining and mineral processing operations bordering the Gulf of St. Lawrence.

Name	Location	Process	Product
Atlantic Minerals Ltd.	Lower Cove	Mining/processing	Limestone; dolomite
Galen Gypsum Mines Ltd.	Flat Bay	Mining	gypsum
Lafarge Gypsum Canada Inc.	Corner Brook	Closed	Closed

Quebec: In Quebec, as many as 23 mining operations and eight mineral processing operations exist along the Gulf of St. Lawrence and connecting watersheds. There are nine mining operations that produce granite, iron ore, titanium, sandstone or salt. The remainder produce sand, gravel and stone. Meanwhile, six of the eight processing operations are aluminum smelters, located along the north shore of the estuary and Saguenay River (Figure 4-28; Table 4-41). These smelting operations account for over 60% of Canada's aluminum production capacity (Aluminum Association of Canada 2002). The presence of an important hydroelectric production capacity in the Saguenay and Côte-Nord regions, coupled with easy marine access for bulk mineral carriers, has led to the development of this aluminum manufacturing industry (St. Lawrence Vision-2000 2004). At least 20 peat extraction sites exist within the Bas-Saint-Laurent region, along the south shore of the estuary, representing 50% of peat production in Quebec. Other peat extraction sites exist on the north shore near Sept-Îles and Port-Cartier. The mining and mineral processing industry contributed $3.7 billion to the provincial economy in 2002, employing 11,000 people directly in mining (Natural Resources Canada 2004*a*).

Table 4-41 Quebec mining and mineral processing operations bordering the Gulf of St. Lawrence.

Name	Location	Process	Product
QIT-Fer et Titane Inc.	Habre-Saint-Pierre	mining	titanium
Wabush Mine	Wabush	processing	iron ore
La Conpagnie Minière Quebec Cartier	Port-Cartier	processing	iron ore
Mines Seleine	Iles-de-la-Madeleine	mining	salt
Aristide Brousseau and Fils Itée	Chandler	mining	sandstone
Les Carrières du Boulevard Inc.	Baie-Comeau	mining	granite
Carrières Marconi Itée	Baie-Comeau	mining	granite
Concassage Mont-Louis Inc.	Saint-Maxime-du-Mont-Louis	mining	sand and gravel
Jean Fournier Inc.	Baie-Comeau	mining	sand and gravel
Laurier Hamilton et Fils Itée	Chandler	mining	sand and gravel
P. and B. Enterprises Itée	Havre-aux-Maisons, Îles-De-La-Madeleine	mining	sandstone
Pavages Beau Bassin Inc.	New Richmond	mining	sandstone
Roland Munger Inc.	Baie-Comeau	mining	sand and gravel
Alouette	Sept-Îles	processing	aluminmum
Canadian Reynolds Metals – Alcoa	Baie-Comeau	processing	aluminmum
Alcan	Jonquière	processing	aluminmum
Alcan	Laterrière	processing	aluminmum
Alcan	La Baie	processing	aluminmum
Alcan	Alma	processing	aluminmum

New Brunswick: In New Brunswick, much of the large scale mining and mineral processing operations occur within the northern part of the province near Bathurst and Belledune (Table 4-42; Figure 4-28). Processing and shipping facilities also exist in Belledune. Lead, zinc and copper are the principal minerals and metals produced within these areas, along with a number of stone producing sites in the southeast part of the province. Meanwhile, the peat industry has more than 40 peat extraction sites located throughout northeastern New Brunswick, contributing an estimated $45 million industry to the economy annually (Government of New Brunswick 2002*a*).

Table 4-42 New Brunswick mining and mineral processing operations bordering the Gulf of St. Lawrence.

Name	Location	Process	Product
Noranda Mining and Exploration Inc.	Belledune	processing	Lead/zinc
Noranda Mining and Exploration Inc. (Brunswick Mine)	Brunswick Mines	mining	Lead/zinc
Breakwater Resources Ltd.	Bathurst	mining	
Noranda Mining and Exploration Inc. (Heath Steele Mine)	Newcastle	mining	Lead/zinc/copper
Elmtree Resources Ltd.	Bathurst	mining	Limestone/dolomite
Smith Cut Stone and Quarry Ltd.	Shediac	mining	sandstone
Maritime Stone Works Inc.	Scoudouc	mining	sandstone
Bastarache Stone Quarry Ltd.	Notre Dame	mining	Sandstone/granite

Nova Scotia: In Nova Scotia, 10 major mining and mineral processing operations are located along the Gulf of St. Lawrence. Coal, limestone and salt are the common minerals extracted from these sites (Table 4-43). The two salt mines in Pugwash and Nappan, operated by the Canadian Salt Co. and Sifto Salt respectively, are accompanied by processing and shipping facilities (Government of Nova Scotia 2003).

Table 4-43 Nova Scotia mining and mineral processing operations bordering the Gulf of St. Lawrence.

Name	Location	Process	Product
Evans Coal Mines Ltd.	St. Rose	mining	coal
Martin Marietta Materials Canada Ltd.	Mulgrave	mining	limestone
Lynx Minerals Inc.	Scotsville	mining	barite
Ridge Brokers Ltd.	Antigonish	mining	limestone
Pioneer Coal Ltd.	Stellarton	mining	coal
Shaw Brick	New Glasgow	mining	shale
Thorburn Mining Ltd.	Coalburn	mining	coal
Wallace Quarry Ltd.	Wallace	mining	sandstone
Canadian Salt Co. Ltd.	Pugwash	mining/processing	salt
Sifto Canada Inc.	Nappan	mining/processing	salt

Prince Edward Island: In Prince Edward Island, small scale aggregate operations (sand and gravel) and peat extraction sites dominate the mineral and processing industry, contributing more than $700 thousand and $2.8 million respectively to the provincial economy in 2002 (Natural Resources Canada 2004*a*).

Summary: The major concern associated with mining and mineral processing operations along the Gulf of St. Lawrence is the release of toxic metals into the coastal and marine environments. Studies completed in New Brunswick during the summer of 2000 showed that the mortality rate and depressions in growth of Atlantic salmon and slimy sculpins paralleled treatment concentrations (80% - 20% - 0%) to which both species were exposed (Dube et al 2005). While 20% discharge predicted potentially favourable conditions to reintroduce native fish species, more research may be required to determine the accumulated effects and re-suspension of contaminated sediment.

4.7.5 Fish Processing Plants

The fish processing industry plays a significant economic role in many coastal communities throughout the Gulf of St. Lawrence. Large portions of the population within many of these communities are either employed within the fish processing industry or accompanying fishing industry.

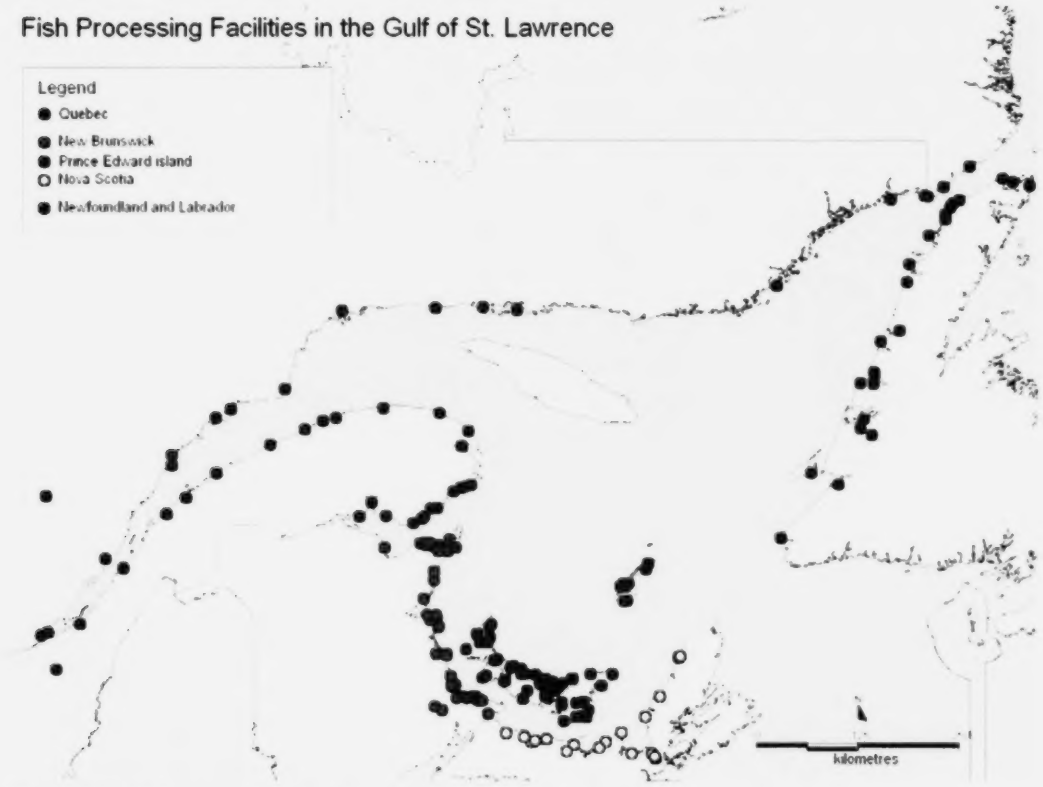

Figure 4-29 Fish processing plants along the Gulf of St. Lawrence.

There are currently more than 200 fish processing plants located throughout the Gulf of St. Lawrence (Figure 4-29; Table 4-44). This number reflects a decrease in areas such as western Newfoundland and southern Labrador, and the Quebec North Shore; areas that depended on groundfish species prior to the groundfish moratorium of the early 1990s. Meanwhile, a number of plants have been refitted to process previously underutilized species such as lobster, crab and shrimp that now dominate the current fishing industry within the Gulf of St. Lawrence. Quebec and New Brunswick account for 34% and 32% respectively of existing fish processing plants along the Gulf of St. Lawrence. Prince Edward Island, Newfoundland and Labrador and Nova Scotia account for 18%, 9% and 7% respectively (Figure 4-29; Table 4-44). Many of these plants process multiple species, while others are dependent on only one or two species. A number of processing plants throughout Prince Edward Island, New Brunswick and Nova Scotia also accommodate the local aquaculture industry, which has seen an increase in production in recent years. Meanwhile, processing operations vary from plant to plant, with many conducting primary processing operations and others producing added value products for export to domestic and international markets.

Table 4-44 Number of fish processing plants currently operating throughout the Gulf of St. Lawrence, 2006.

Province	Number of Fish Processing Plants
Newfoundland and Labrador	20
Quebec	72
New Brunswick	68
Nova Scotia	16
Prince Edward Island	38
Total	214

Source: DFO Newfoundland and Labrador, Gulf and Quebec Regions 2006.

The licensing of fish processing plants falls under the jurisdiction of the respective provincial governments (Table 4-45). Environment Canada administers legislation (under the Fisheries Act and Canadian Environmental Protection Act) regarding the release of contaminants into the marine environment, including wastewater discharge and disposal of fish offal at sea.

Table 4-45 Provincial authorities and legislation respecting the licensing of fish processing plants.

Province	Authority	Legislation
Newfoundland and Labrador	Department of Fisheries and Aquaculture	Aquaculture Act
Quebec	Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec	Food Products Act and Regulations
New Brunswick	Department of Agriculture, Fisheries and Aquaculture	Fish Processing Act
Nova Scotia	Department of Agriculture and Fisheries	Fisheries and Coastal Resources Act
Prince Edward Island	Department of Agriculture, Fisheries, Aquaculture and Forestry	Fisheries Act

Fish processing plants utilize and discharge large amounts of water during everyday processing operations. Effluent released into the Gulf of St. Lawrence as a result of processing operations has the potential to impact the ecosystem through the discharge of suspended organic and inorganic materials, and may have negative impacts on tourism and other coastal industries within the immediate area. Disposal of fish offal must meet the approval of authorities for offshore (federal) and land-fill disposal sites (provincial).

4.7.6 Agriculture

Agriculture plays a significant role in the socio-economic development of provinces bordering the Gulf of St. Lawrence. The industry is focused on both primary and secondary production targeting domestic and international markets. In 2000, "farm cash receipts" for the five provinces bordering the Gulf of St. Lawrence totalled $6.6 billion (Statistics Canada 2001*d*), with Quebec accounting for 81% of the total; New Brunswick, Nova Scotia, and Prince Edward Island each representing 6%; and Newfoundland and Labrador 1% (Table 4-46).[46]

46 Farm cash receipts (FCR) represent the cash income received from the sale of agricultural commodities as well as direct program payments made to support or subsidize the agricultural sector. The sector includes all agricultural holdings with annual sales of agricultural products of at least $250.00.

Table 4-46 Total agricultural incomes for Quebec and the Atlantic provinces based on farm cash receipts for 2000.

Province	Total Farm Cash Receipts
Newfoundland and Labrador	$ 90,000,000
Quebec	$6,100,000,000
New Brunswick	$ 445,000,000
Nova Scotia	$ 460,000,000
Prince Edward Island	$ 396,000,000
Total	$7,491,000,000

Coastal farm acreage along the Gulf of St. Lawrence represents 26% (1,180,660 hectares) of total farm acreage throughout Quebec and the Atlantic provinces. Approximately 51% of this coastal farm acreage is located within Quebec, 9% in New Brunswick, 17% in Nova Scotia, 22% in Prince Edward Island, and only 1% in Newfoundland and Labrador (Table 4-47).

Table 4-47 Number of farms reporting and farm acreage in 2000 for coastal areas bordering the Gulf of St. Lawrence.

Province	# Farms Reporting	Farm Acreage (ha)
Newfoundland and Labrador	151	12,301
Quebec	5,120	603,320
New Brunswick	1,008	105,549
Nova Scotia	1,638	198,008
Prince Edward Island	1,845	261,482
Total	9,762	1,180,660

The collecting of agricultural data for Quebec and the Atlantic provinces proved to be a challenge. Most provinces depend on Statistics Canada to provide statistical data for agricultural activities. The information available provides a general overview of agricultural activity on a provincial and regional (county, regional county municipality) scale, but lacks to provide localized agricultural activity in relation to the Gulf of St. Lawrence, estuary and major watershed areas. Statistics Canada provides data regarding number of farms, farm acreage and land inputs of chemical agricultural products and applications, but suggests that this information is under-reported. As much of the data in this document is taken from the 2001 Census of Agriculture, it is important to provide the reader with a clear understanding of how data is presented. For the purpose of this document, data is displayed for the following geographical levels: provincial, census agricultural regions[47] (CAR) and census divisions[48] (CD).

47 A census agricultural region is a sub-provincial geographic area used by the Census of Agriculture for disseminating agricultural statistics. In NL, NS, NB and Quebec, census agricultural regions are composed of groups of adjacent census divisions. In PEI, each of the three counties is treated as a census agricultural region for the purpose of disseminating statistical data.

48 Census division is the general term for provincially legislated areas (such as county, regional county municipality and regional district) or their equivalents. In NS, NB and PEI, census divisions represent counties; and in Quebec, regional county municipalities. In Newfoundland and Labrador; counties, regional county municipalities and regional districts do not exist. Statistics Canada, in cooperation with the Newfoundland and Labrador government, has created equivalent areas called census divisions for disseminating statistical data. For Newfoundland and Labrador, a census division may encompass one or more economic zones or a portion of an economic zone.

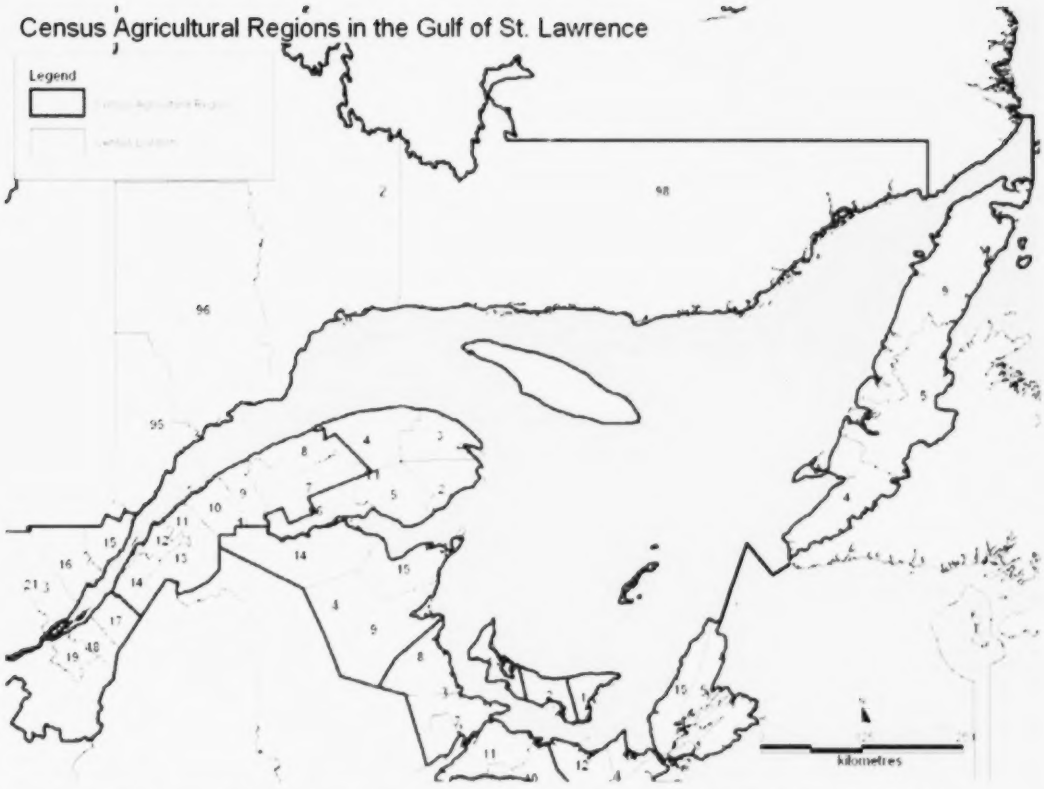

Figure 4-30 Census Agricultural Regions (CAR) bordering the Gulf of St. Lawrence. Courtesy of Statistics Canada. 2001.

Newfoundland and Labrador: The Department of Forest Resources and Agrifoods is the authority for agriculture activity in Newfoundland and Labrador. Census Agricultural Region (CAR) 3 covers the entirety of western Newfoundland and Labrador encompassing Census divisions 4 (Port au Port Peninsula, Stephenville, Bay St. George South and the Codroy Valley areas), 5 (Bay of Islands and the Humber Valley), 9 (Northern Peninsula) and 10 (Labrador); (Figure 4-30). [49] CAR 3 represents only 1% of farm acreage along the Gulf of St. Lawrence and approximately 30% of farm acreage within Newfoundland and Labrador (Table 4-48); (Statistics Canada 2001*e*). The major areas of agriculture activity in the region are concentrated in the Codroy Valley/Bay St. George South and the Humber Valley areas. Beef, dairy, vegetable, small fruit and greenhouse operations are the most common farming operations throughout the region. Eleven dairy farms operate throughout western Newfoundland and Labrador; seven in the Humber Valley area, three in the Codroy Valley/Bay St. George South area, and one on the northern peninsula. The region accounts for 60% of the province's beef operations, which are generally small and family based (Ricketts 2004). Forty-eight farms in the region reported land applications of manure through solid and/or liquid surface application methods (Table 4-49). Farm cash receipts for the agriculture industry in Newfoundland and Labrador totalled $90 million in 2000, with the dairy, broiler, egg production and nursery industries accounting for 34%, 20%, 13% and 13% respectively.

49 Due to confidentiality constraints and the areas having very few farms, the data for Census divisions 9 & 10 have been combined with the data from Census division 5. With the exception of one dairy farm in the community of Daniel's Harbour (Census division 9), agriculture activity along the northern peninsula (Census division 9) and southern Labrador (Census division 10) is limited to small personal use farms and manual harvesting of wild berries (bakeapples, partridge berries, and blue berries).

Table 4-48 Number of farms reporting and total area of farms within Newfoundland and Labrador Census divisions bordering the Gulf of St. Lawrence.

Geographic name - (Geographic level)	Total area of farms	
	Farms reporting	Hectares
Newfoundland and Labrador	643	40,578
Census Agricultural Region 3 (CAR)	151	12,301
Census Division (CD - 4)	51	4,892
Census Division (CD - 5)[1]	100	7,409

[1]Due to confidentiality constraints and the areas having very few farms, the data for *Census Divisions 9 & 10* have been combined with the data from *Census Division 5*.

Source: Statistics Canada 2001.

Table 4-49 Farms reporting land inputs within Newfoundland and Labrador Census divisions bordering the Gulf of St. Lawrence.

Geographic name (Geographic level)	Use of irrigation		Use of commercial fertilizer[2]		Use of herbicides[2]		Use of insecticides[2]		Use of fungicides[2]	
	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares
Newfoundland and Labrador	51	188	352	6,415	140	1,067	151	641	61	310
Census Agricultural Region 3 (CAR)	15	91	95	2,918	30	335	31	127	17	81
Census Division (CD - 4)	3	3	32	1,085	13	200	13	57	8	30
Census Division (CD - 5)[1]	12	89	63	1,833	17	136	18	70	9	51

[1]Due to confidentiality constraints and the areas having very few farms, the data for *Census Divisions 9 & 10* have been combined with the data from *Census Division 5*.

[2] As in previous censuses, the area of land on which herbicides, insecticides, fungicides, and commercial fertilizer were applied is under-reported. However, the 1996 and 2001 data are comparable.

Source: Statistics Canada 2001.

Nova Scotia: The Department of Agriculture and Fisheries is the lead agency for agriculture in Nova Scotia. Agriculture associations supporting the interests of the agricultural industry include the Nova Scotia Federation of Agriculture, Nova Scotia Cattlemen's Association, and the Dairy Farmers of Nova Scotia. Census divisions 10 (Colchester), 11 (Cumberland), 12 (Pictou), 14 (Antigonish), and 15 (Inverness) account for 17% of farm acreage along the Gulf of St. Lawrence and approximately 49% of farm acreage within the province (Figure 4-30; Table 4-50); (Statistics Canada 2005). The Annapolis Valley and central Nova Scotia are the major areas for agriculture activity, accounting for 31% and 29% of farms respectively. In 2001, Statistics Canada reported beef farming, fruit production and Christmas tree production as the most common agricultural activities in Nova Scotia. Blueberry production accounts for 81% of fruit production in Nova Scotia. Cumberland County accounted for 57% (8,490 hectares) of Nova Scotia's blueberry production in 2001. In 2001, farms reported solid and/or liquid surface applications as the major methods of applying manure to land, followed by liquid injection and irrigation methods (Table 4-51). Farm cash receipts for Nova Scotia's agricultural industry totalled $460 million in 2000.

Table 4-50 Number of farms reporting and total area of farms within Nova Scotia's counties bordering the Gulf of St. Lawrence.

Geographic name - (Geographic level)	Total area of farms	
	Farms reporting	Hectares
Nova Scotia	3,923	407,046
Agricultural Region 3 - (CAR)	1,143	134,779
Colchester County - (CD - 10)	452	52,540
Cumberland County - (CD - 11)	539	68,941
Agricultural Region 4 - (CAR)	599	74,477
Pictou County - (CD - 12)	274	30,148
Antigonish County - (CD - 14)	235	29,899
Agricultural Region 5 - (CAR)	287	29,731
Inverness County - (CD - 15)	138	16,480

Source: Statistics Canada 2001.

Table 4-51 Farms reporting land inputs within Nova Scotia Counties bordering the Gulf of St. Lawrence.

Geographic name (Geographic level)	Use of irrigation		Use of commercial fertilizer[1]		Use of herbicides[1]		Use of insecticides[1]		Use of fungicides[1]	
	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares
Nova Scotia	300	3,491	2,336	88,374	1,215	29,686	713	16,183	534	12,034
Agricultural Region 3 - (CAR)	59	245	701	28,233	448	9,354	212	4,318	156	3,836
Colchester County - (CD - 10)	25	106	301	13,727	179	3,501	71	1,417	50	931
Cumberland County - (CD - 11)	28	129	311	11,054	244	5,498	131	2,887	98	2,838
Agricultural Region 4 - (CAR)	23	155	369	13,797	182	2,953	56	854	44	598
Pictou County - (CD - 12)	12	x	158	5,600	87	1,577	25	431	24	386
Antigonish County - (CD - 14)	10	119	158	6,855	64	957	17	187	15	128
Agricultural Region 5 - (CAR)	16	57	149	4,464	46	304	20	185	14	47
Inverness County - (CD - 15)	1	x	70	2,748	19	169	3	5	3	7

[1] As in previous censuses, the area of land on which herbicides, insecticides, fungicides, and commercial fertilizer were applied is under-reported. However, the 1996 and 2001 data are comparable.

x Suppressed to protect confidentiality

Source: Statistics Canada 2001.

New Brunswick: The Department of Agriculture, Fisheries and Aquaculture is the authority for agriculture activity in New Brunswick. Census divisions 14 (Restigouche), 15 (Gloucester), 9, (Northumberland), 8 (Kent), and 7 (Westmorland) account for approximately 9% of farm acreage along the Gulf of St. Lawrence and 27% of the farm acreage within the province (Figure 4-30; Table 4-52); (Statistics Canada 2005). Beef farms, fruit operations (mainly blueberries) and dairy farms are the most common agricultural operations throughout the region. Approximately 70% (approximately5,600 hectares) of blueberry production occurs along the Acadian Peninsula in Gloucester and Northumberland Counties. In 2001, farms reported solid and/or liquid surface applications as the major methods of applying manure to land, followed by liquid injection and irrigation methods (Table 4-53). Farm cash receipts throughout the province totalled $445 million in 2000.

Table 4-52 Number of farms reporting and total area of farms within New Brunswick's counties bordering the Gulf of St. Lawrence.

Geographic name - (Geographic level)	Total area of farms	
	Farms reporting	Hectares
New Brunswick	3,034	388,053
Agricultural Region 3 - (CAR)	715	77,877
Westmorland County - (CD - 7)	418	47,005
Kent County - (CD - 8)	177	19,033
Agricultural Region 4 - (CAR)	413	39,511
Northumberland County - (CD - 9)	117	9,838
Restigouche County - (CD - 14)	89	15,547
Gloucester County - (CD - 15)	207	14,126

Source: Statistics Canada 2001.

Table 4-53 Farms reporting land inputs within New Brunswick counties bordering the Gulf of St. Lawrence.

Geographic name (Geographic level)	Use of irrigation		Use of commercial fertilizer[1]		Use of herbicides[1]		Use of insecticides[1]		Use of fungicides[1]	
	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares
New Brunswick	156	1,144	1,806	90,067	995	54,018	640	29,118	436	26,504
Agricultural Region 3 - (CAR)	42	280	401	14,711	161	3,485	67	1,004	39	862
Westmorland County - (CD - 7)	24	157	231	9,764	98	2,212	34	432	23	477
Kent County - (CD - 8)	15	106	112	3,420	46	1,067	28	530	13	315
Agricultural Region 4 - (CAR)	21	82	234	8,994	171	5,804	82	1,908	46	1,239
Northumberland County - (CD - 9)	7	8	86	2,355	49	966	25	381	7	141
Restigouche County - (CD - 14)	0	0	40	3,621	24	2,877	12	335	10	346
Gloucester County - (CD - 15)	14	74	108	3,018	98	1,961	45	1,191	29	752

[1] As in previous censuses, the area of land on which herbicides, insecticides, fungicides, and commercial fertilizer were applied is under-reported. However, the 1996 and 2001 data are comparable.

Source: Statistics Canada 2001.

Prince Edward Island: The Department of Agriculture, Fisheries, Aquaculture and Forestry is the administrative agency for agriculture in Prince Edward Island. Prince Edward Island is divided into three Census Agricultural Regions: CAR 1 (Kings County), CAR 2 (Queens County), and CAR 3 (Prince County); (Figure 4-30). Prince Edward Island has approximately 260,000 hectares of land for agricultural use, accounting for more than one-third of the province's total land area (Table 4-54); (Statistics Canada 2005). In 2001, 1,845 farms employed some 4,000 primary workers. Potato production increased to 42,756 hectares, accounting for 25% of the province's total crop production. Prince County accounted for 55% of total potato acreage in 2001. Secondary processing has directly influenced the increase in potato production, utilizing 45% of the crop. There are approximately 270 dairies and 175 hog farms distributed throughout the province. Beef production accounts for 35% of all farms, with larger feed lots situated in the Kensington – Summerside area. Other major commodities include vegetable and small fruit crops (Government of Prince Edward Island 2001). In 2001, farms reported solid and/or liquid surface applications as the major methods of applying manure to land (Table 4-55). In 2000, farm cash receipts for Prince Edward Island's agriculture industry totalled $396 million with potato production accounting for more than 45 % of the total.

Table 4-54 Number of farms reporting and total area of farms within Prince Edward Island.

Geographic name - (Geographic level)	Total area of farms	
	Farms reporting	Hectares
Prince Edward Island	1,845	261,482
Agricultural Region 1 - (Kings County)	322	52,790
Agricultural Region 2 - (Queens County)	905	106,075
Agricultural Region 3 - (Prince County)	618	102,617

Source: Statistics Canada 2001.

Table 4-55 Farms reporting land inputs within Prince Edward Island.

Geographic name - (Geographic level)	Use of irrigation		Use of commercial fertilizer[1]		Use of herbicides[1]		Use of insecticides[1]		Use of fungicides[1]	
	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares
Prince Edward Island	38	739	1,232	110,102	1,087	92,732	605	45,260	519	44,548
Agricultural Region 1 - (Kings County)	3	5	193	18,587	182	17,302	96	7,665	90	7,884
Agricultural Region 2 - (Queens County)	18	80	602	44,049	509	34,352	226	12,323	174	11,509
Agricultural Region 3 - (Prince County)	17	655	437	47,466	396	41,078	283	25,272	255	25,155

[1] As in previous censuses, the area of land on which herbicides, insecticides, fungicides, and commercial fertilizer were applied is under-reported. However, the 1996 and 2001 data are comparable.

Source: Statistics Canada 2001.

Quebec: Le ministère de l'Agriculture, des Pêcheries et de l'Alimentation is the authority for agriculture activity in the province of Quebec. Quebec's agricultural industry bordering the Gulf of St. Lawrence and estuary is represented by 25 Census divisions (CD): CD 1 to 21 and CD 95 to 98, each representing a specific Regional County Municipality (Figure 4-30; Table 4-56); (Statistics Canada 2005). Census divisions along the Quebec South Shore account for 14% and 16% of Quebec farms and farm acreage respectively. Census divisions along the North Shore account for only 2% of farms and farm acreage. Agriculture activity is most heavily concentrated within Bas-Saint-Laurent (CD 7 to 14) and Chaudière-Appalaches (CD 17 to 19); (Table 4-56). Beef and dairy operations are the most common types of farms in these Census divisions, as well as greenhouse, vegetable and other livestock operations. In 2001, farms reported solid surface applications as the major method of applying manure to land, followed by liquid surface applications (Table 4-57). Quebec's farm cash receipts totalled $6.1 billion in 2000.

Table 4-56 Number of farms reporting and total area of farms within Quebec regional county municipalities bordering the Gulf of St. Lawrence and estuary.

Geographic name - (Geographic level)	Total area of farms	
	Farms reporting	Hectares
Quebec	32,139	3,417,026
Bas-Saint-Laurent - (CAR - 1)	2,436	350,251
La Matapédia - (CD - 7)	258	47,605
Matane - (CD - 8)	158	26,165
La Mitis - (CD - 9)	308	44,776
Rimouski-Neigette - (CD - 10)	294	38,513
Les Basques - (CD - 11)	231	37,098
Rivière-du-Loup - (CD - 12)	297	39,868
Témiscouata - (CD - 13)	437	65,369
Kamouraska - (CD - 14)	453	50,857
Saguenay--Lac-Saint-Jean/Côte-Nord - (CAR - 2)	1,227	196,640
La Haute-Côte-Nord - (CD - 95)	37	8,377
Manicouagan - (CD - 96)[1]	26	1,522
Québec - (CAR - 3)	1,156	106,400
Charlevoix-Est - (CD - 15)	79	9,644
Charlevoix - (CD - 16)	128	11,418
L'Île-d'Orléans - (CD - 20)	187	13,643
La Côte-de-Beaupré - (CD - 21)	78	7,061
Gaspésie--Îles-de-la-Madeleine - (CAR - 11)	292	43,552
Les Îles-de-la-Madeleine - (CD - 1)	19	529
Le Rocher-Percé - (CD - 2)	33	3,153
La Côte-de-Gaspé - (CD - 3)	21	3,545
La Haute-Gaspésie - (CD - 4)	33	3,231
Bonaventure - (CD - 5)	112	17,856
Avignon - (CD - 6)	74	15,238
Chaudière-Appalaches - (CAR - 12)	6,015	507,811
L'Islet - (CD - 17)	562	50,792
Montmagny - (CD - 18)	331	32,195
Bellechasse - (CD - 19)	964	74,865

[1]Due to confidentiality constraints and the areas having very few farms, the data for *Sept-Rivières - Caniapiscau, and Minganie - Basse-Côte-Nord* have been combined with the data from *Manicouagan*.

Source: Statistics Canada 2001.

Table 4-57 Farms reporting land inputs within Quebec regional county municipalities bordering the Gulf of St. Lawrence and estuary.

Geographic name - (Geographic level)	Use of irrigation[2]		Use of commercial fertilizer[3]		Use of herbicides[3]		Use of insecticides[3]		Use of fungicides[3]	
	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares	Farms reporting	Hectares
Quebec	1,307	22,578	16,593	1,001,733	14,456	848,220	3,037	90,415	2,448	73,323
Bas-Saint-Laurent - (CAR - 1)	36	458	1,266	61,662	1,039	38,910	92	2,343	68	1,720
La Matapédia - (CD - 7)	2	x	149	9,123	120	5,511	5	54	1	x
Matane - (CD - 8)	5	19	89	4,379	65	2,376	7	102	4	x
La Mitis - (CD - 9)	5	33	180	9,123	119	4,360	8	121	8	144
Rimouski-Neigette - (CD - 10)	4	22	141	8,069	130	4,957	8	202	6	225
Les Basques - (CD - 11)	2	x	121	6,597	98	4,698	18	568	9	296
Rivière-du-Loup - (CD - 12)	7	109	182	8,033	160	5,575	22	500	19	482
Témiscouata - (CD - 13)	3	252	121	5,614	84	3,356	7	400	4	281
Kamouraska - (CD - 14)	8	13	283	10,724	263	8,077	17	396	17	225
Saguenay--Lac-Saint-Jean/Côte-Nord - (CAR - 2)	39	522	603	38,456	601	35,803	73	3,437	47	3,022
La Haute-Côte-Nord - (CD - 95)	0	0	22	778	7	x	0	0	0	0
Manicouagan - (CD - 96[1]	3	6	13	123	1	x	2	x	4	17
Québec - (CAR - 3)	81	947	525	25,100	493	19,664	201	6,348	184	4,911
Charlevoix-Est - (CD - 15)	1	x	15	177	15	233	3	5	1	x
Charlevoix - (CD - 16)	3	14	54	1,213	42	967	7	67	6	62
L'Île-d'Orléans - (CD - 20)	51	823	131	4,696	129	4,568	113	2,864	110	2,859
La Côte-de-Beaupré - (CD - 21)	5	52	36	739	31	549	16	110	15	106
Gaspésie--Îles-de-la-Madeleine - (CAR - 11)	10	37	146	5,693	97	3,439	23	446	17	240
Les Îles-de-la-Madeleine - (CD - 1)	0	0	3	52	2	x	0	0	0	0
Le Rocher-Percé - (CD - 2)	1	x	12	271	10	145	3	4	1	x
La Côte-de-Gaspé - (CD - 3)	6	6	9	195	4	x	3	12	3	7
La Haute-Gaspésie - (CD - 4)	1	x	11	335	6	60	3	11	1	x
Bonaventure - (CD - 5)	1	x	62	2,541	44	1,910	9	240	8	207
Avignon - (CD - 6)	1	x	49	2,299	31	1,290	5	179	4	x
Chaudière-Appalaches - (CAR - 12)	76	1,155	2,122	71,993	1,657	52,494	199	3,715	151	2,807
L'Islet - (CD - 17)	11	66	136	4,493	120	3,898	18	137	15	102
Montmagny - (CD - 18)	2	x	123	4,307	114	3,469	15	131	10	84
Bellechasse - (CD - 19)	19	94	407	13,696	364	12,051	39	1,006	29	834

[1] Due to confidentiality constraints, the data for Sept-Rivières - Caniapiscau, and Minganie - Basse-Côte-Nord have been combined with the data from Manicouagan.

[2] Due to response errors in 1996, the area of land irrigated was overstated in Quebec. These errors limit the comparability of the data between 1996 and 2001.

[3] As in previous censuses, the area of land on which herbicides, insecticides, fungicides, and commercial fertilizer were applied is under-reported. However, the 1996 and 2001 data are comparable.

x Suppressed to protect confidentiality

Source: Statistics Canada 2001.

Summary: Along the Gulf of St. Lawrence, the agriculture industry is most highly concentrated throughout Prince Edward Island, Nova Scotia North Shore, the Bas-Saint-Laurent/Chaudière-Appalaches areas of Quebec and southeastern New Brunswick. The 2001 Census of Agriculture reports that application of chemicals and solid/liquid manure to farmland is a common practice throughout all agricultural areas along the Gulf of St. Lawrence. The Census also reports that this practice is under reported although statistics for 1996 and 2001 are comparable. Land use is a significant contributor of nutrients to estuaries (Meeuwig 1999). Since the 1970s, the risk of erosion from agricultural activity in Prince Edward Island is classified as high (Cairns 2002). Meanwhile, modern agricultural practices contributing to these sources of contamination are not limited to Prince Edward Island, but occur in all agricultural areas. Soil erosion, chemical leaching and runoff, and wetland conversion (i.e. loss of salt marshes) impact on water quality of coastal areas, and contribute to the loss of fish and wildlife resources, and other industrial opportunities (fisheries, aquaculture and tourism); (Crutchfield 1993).

4.7.7 Dredging

Introduction : Marine dredging activity occurs throughout the Gulf of St. Lawrence, providing safe passage and docking facilities for commercial and recreational vessels. This activity consist of channel and basin dredging, and beach levelling occurring mainly within coastal waters such as bays, harbours and estuaries. Many of these locations require dredging activity periodically (i.e. annually, 2 – 5 years) as a result of continuous erosion and sedimentation activity generated by wind, wave, and ocean current activity; ice rafting and scouring; and disposition by rivers and streams.

Fisheries and Oceans Canada, Small Craft Harbours Branch operates and maintains a national system of harbours, providing commercial fish harvesters and recreational boaters with safe and accessible facilities. Fisheries and Oceans Canada has transferred operational responsibilities of many of these harbours over to harbour authorities. Similarly, Transport Canada has authority over major commercial ports, but in recent years has transferred operational responsibilities for many of these ports to municipal and corporate authorities. Meanwhile, there may be other ports and marinas throughout the Gulf of St. Lawrence that are operated by federal or provincial government agencies, municipalities, corporate authorities, non-governmental organizations and private individuals.

Over the past 10 years, Fisheries and Oceans Canada, Habitat Management Division received approximately 1300 referrals for marine and inland dredging projects throughout the Gulf of St. Lawrence. Approximately 400 of these referrals were identified as occurring in marine and estuarine areas, 130 within inland waters (rivers and streams) and another 770 records in the database did not identify type of habitat. More than 50% of the unidentified referrals were requested by federal proponents, leaving to believe that a large number of these referrals may have been marine based. Data for 2005 was the most complete with 101 referrals to conduct dredging activities. Eighty-three of these proposed dredging projects were in marine and estuarine waters. While it is not mandatory for proponents to report dredging activity, it is believed that dredging activity throughout the Gulf of St. Lawrence is much more extensive than recorded.

Hydraulic (suction dredges) and mechanical (excavators with a clamshell or spoon attachment) methods are commonly used for dredging activities throughout the Gulf of St. Lawrence. Suction dredges have a rotary head at the end of a pipe system, and a hydraulic pump which siphon sediment and water (mixture is approximately 20% sediment and 80% water), depositing it at an adjacent location or onto a barge for disposal at an offshore location. Excavators with clamshell or spoon attachments operate from land, barges or temporary roads built to access the marine site. Blasting operations may be used for the removal of solid substrate, but this is very rare and generally results in a one time operation. Disposal methods for dredge material include side casting on site, trucking to an approved land-based disposal site, or offshore disposal utilizing barges. According to online notices for dredging activity posted by the Canadian Environmental Protection Agency, suction dredges and barges are common dredging and disposal methods used in marine areas along New Brunswick and Prince Edward Island, sometimes in conjunction with clamshell dredges (Environment Canada 2005*c*). Along Newfoundland and Labrador, Quebec and Nova Scotia, clamshell dredges are commonly used. In Quebec, tow scows or levelling beams are used to level dredge material at marine disposal sites. Similarly in Newfoundland and Labrador, tractors and excavators are used to level beaches due to sediment build-up caused by natural ocean activity (wind, waves and ice). The method used to conduct dredging activities at specific sites depend on a number of factors including the type of substrate involved, scale of the project and the sensitivity of the area being dredged (Environment Canada 1985).

The structural changes in benthic communities generally result from changes in sediment type. The effect of dredging activity and ocean disposal of dredge material resembles that of natural erosion and sedimentation processes within the marine environment (Levings 1982). The major difference is that the natural process occurs over a longer period, so the effects of this activity may have less of an

impact. Environmental effects of marine dredging activity and ocean disposal of sediments can be divided into four major categories: physical, chemical, biological and social impacts (Environment Canada 1985).

Ocean disposal of sediments cause temporary turbidity in the water column, resulting in decreased light penetration. Ocean disposal may alter the physical habitat through a blanketing effect. Meanwhile, ocean currents at the disposal site have the potential to redeposit fine suspended sediments in other areas.

Chemical impacts are a major concern, especially in areas where there has been a history of contamination from municipal waste disposal and coastal industries such as pulp and paper mills, mineral processing plants and agricultural activity. Re-suspension of contaminated sediments at both dredging and marine disposal sites is a major concern as the finer sediments along with organic, inorganic matter and toxic metals have the potential to disperse throughout the ecosystem and become ingested by marine species. Disturbance of organic waste (i.e. wood waste) and the accumulation of nutrients from municipal waste and agricultural activity contribute to the depletion of dissolved oxygen in marine and estuarine areas.

Re-deposition of sediments at both the dredging and disposal sites may result in the redistribution or disappearance of benthic organisms and colonization by other species. A decrease in dissolved oxygen and distribution of toxins throughout the food chain may result in the loss of a number of benthic species. Turbidity and re-disposition of sediments may also damage spawning and nursery areas. Previous research shows that turbidity has minimal impact on phytoplankton, but near shore algae (kelp beds) may be damaged by ocean dumping. Field surveys in Miramichi Bay show that sediment deposited on herring spawn will increase egg mortality. Suspended sediments may also induce earlier hatching and inhibit the feeding of juvenile herring. Juvenile herring are likely to avoid dredging and oceans disposal areas while suspended sediments are present (Messieh et al. 1981).

Dredging activity, if not carefully timed and monitored can have a number of social impacts including damage to commercial fishing and aquaculture habitat, and interference with commercial fishing, recreational boating and tourism activities.

Environmental Assessment and Mitigation Process: Dredging activity and the marine disposal of dredge material have the potential to impact fish and fish habitat. Section 35 of the Fisheries Act addresses the physical aspects of fish habitat, prohibiting the harmful alteration, disruption or destruction of habitat. While there is no requirement to report proposed dredging activities to Fisheries and Oceans Canada, Habitat Management Division, the proponent will be liable under Section 35 of the Fisheries Act in the case that "harmful alteration, disruption or destruction" (HADD) of fish habitat has occurred.

In cases where dredging activity is reported, whether directly through the proponent or through a referral from other departments or agencies associated with the project, Fisheries and Oceans Canada, Habitat Management Division will review the project and address the request accordingly:

- where there is no potential for the "harmful alteration, disruption or destruction" (HADD) of marine habitat, the Habitat Management Division will advise the proponent that Fisheries and Oceans Canada has no concerns with the project;
- where there is potential for a HADD, but measures can be taken to avoid it, the department will provide a letter of advice to the proponent, stating measures to be taken to avoid the HADD; or
- in the case that an HADD cannot be avoided, DFO may issue an authorization to the proponent under Section 35 of the Fisheries Act, stating measures to be taken to compensate for loss of fish habitat (i.e. replacement or maintenance of affected habitat). An environmental assessment must be completed in accordance to the Canadian Environmental Assessment Act before Fisheries and Oceans can issue an authorization.

Fisheries and Oceans Canada's Habitat Management Program focuses on the conservation and protection of fish habitat, delivering its responsibilities under the Fisheries Act, the Canadian Environmental Assessment Act, and the Species at Risk Act (SARA). Under the new Environmental Process Modernization Plan, Fisheries and Oceans Canada has developed national operational statements and technical guidelines to assist proponents with the identification of mitigation measures associated with low risk, routine maintenance dredging activities. This process eliminates the need for Fisheries and Oceans Canada to review low risk projects, allowing resources and efforts to be allocated to higher risk projects.

Marine dredging projects may be subject to an environmental assessment process under federal and/or provincial legislation to determine if the activity will have an adverse effect on marine species and habitat within the immediate area, and if there is a requirement for mitigation measures. At the federal level, the Canadian Environmental Assessment Agency obtains its authority to facilitate environmental assessments from the Canadian Environmental Assessment Act. Meanwhile, the proponent of the project is responsible for conducting the environmental assessment.

The Canadian Environmental Assessment Act applies:

- when a project is proposed and it is a physical activity in the Inclusion List Regulations (dredging activity and marine disposal of dredging material are included in the Inclusion List Regulations);
- when a federal authority has a decision making responsibility (proponent) associated with the project;
- when the functions (issuing permits, granting approvals, providing funding) of the federal authority requires it to conduct an environmental assessment under the Act; and
- and the activity is not included in the Exclusion List Regulations as a project likely to have significant environmental effects.

Marine dredging activity may be exempt from an environmental assessment process if it is a response to national emergency where measures are required under the Emergencies Act, or to an emergency where it prevents damage to property, the environment or is in the best interest of public health and safety (Canadian Environmental Assessment Agency 2006).

Environmental assessments described under the Canadian Environmental Assessment Act include screenings, comprehensive studies, mediations and review panels. The majority of marine dredging projects throughout the Gulf of St. Lawrence are assessed through screenings, an assessment process which address projects that generally have a minimum impact on the environment. Screenings are developed in accordance to the Federal Coordination Regulations (FCR) where all projects are referred to Environment Canada, Fisheries and Oceans Canada, Transport Canada and relevant provincial regulatory authorities for review and approval. Projects are then posted in the Canadian Environmental Assessment Registry for 15 days for public viewing prior to being released (Canadian Environmental Assessment Agency 2006).

Class Screenings include model class and replacement class screenings:

- Model class screening reports define a class for similar projects, allowing responsible authorities to use this information to prepare individual screening reports for projects within the class, and declaring significant environmental effects for individual projects.
- Replacement class screenings provide a single environmental assessment and report for all projects within a class.

This approach allows for screening of annual re-dredging projects that are not likely to have a significant impact on fish habitat, and at the same time eliminate unnecessary duplication, resulting in significant cost and time savings. A similar approach has been taken by a number of provincial agencies to provide necessary approvals that address a number of projects over a specified time period.

Comprehensive studies are generally required to assess larger dredging projects that may have significant adverse effects on the environment and generally generate public concern. In the case of mediation, the Minister of Environment may appoint a mediator to help interested parties resolve issues associated with the project. The Minister may also appoint a review panel to provide expert advice on issues associated with a project, where adverse environmental effects are likely.

Provincial jurisdictions apply to coastal areas (generally above the high water mark) where many dredging projects overlap with federal jurisdiction. Bilateral agreements and project-specific arrangements (i.e. joint review panels) between federal and provincial jurisdictions ensure that all legal requirements are addressed and help to prevent duplication by ensuring a project is only subject to a single environmental assessment.

Marine dredging and disposal activity that is subject to an environmental assessment must undergo a Marine Sediment Sampling Program to ensure sediment is acceptable for marine or land based disposal. The Canadian Environmental Protection Act applies to the ocean disposal of dredging material. Meanwhile, provincial governments authorize the disposal of dredging material at land-based sites within their respective provinces.

Mitigation measures are put in place to lessen the impact of dredging activity and ocean disposal of dredge material within the marine environment. These measures vary from project to project and are dependent on scale, duration and location of the project, the sensitivity of the area, and the type of sediment involved. The initial approach would be to avoid dredging within sensitive habitat (spawning and nursery areas, and migratory corridors) and marine areas where contaminated sediments have accumulated.

A number of mitigations used within the Gulf of St. Lawrence to reduce turbidity and suspended solids in the water column include selection of dredge type, adjustment of dredge operating technique, use of silt curtains, below surface disposal of sediments and timing restrictions (Thomas 1985). Suction dredges are known to cause the least re-suspension of sediments in the upper water column. Clamshell dredges, the other major dredging method used in the Gulf of St. Lawrence, contribute to turbidity within the upper water column, although this effect is reduced by clamshell dredges with sealed buckets. The adjustment in the operating technique of dredges (i.e. avoid dragging the dredging equipment along the ocean bottom) can also contribute to the reduction of turbidity. Suction dredging may result in greater turbidity at the disposal site due to sediments being crushed during the dredging process (Environment Canada 1985). Timing restrictions are placed on dredging activity within the Gulf of St. Lawrence to minimize the impact of turbidity on spawning and feeding activities of migratory fish species. Timing also restricts dredging activity to periods of low tide and minimal wave action. Timing the use of suction dredges is crucial as fish can become entrained in the suction current of the dredge. Silt curtains are used to restrict the dispersing effect of suspended sediments, but are better suited for enclosed areas that are shelter from wind and wave action (Thomas 1985). Mitigation techniques are extremely important when it comes to dredging and disposal of contaminated sediments. Contaminated sediments are transported to an approved land-based disposal site.

In occurrences where fish habitat has been altered, disrupted or destroyed, proponents of such a project may be required to compensate for those losses. Compensation is generally in the form of restoring or creating new habitat within the immediate area or other marine areas where habitat have been compromised.

Summary: Impacts on sensitive marine habitat (spawning and nursery areas, and migration routes) and the disturbance of contaminated sediments are the most significant concerns associated with marine dredging and ocean disposal of dredge material. Sediment disposal is known to increase egg mortality of species such as herring. Suspended sediments also inhibit the feeding habits and contribute to the avoidance of dredging and ocean disposal areas by some species (Messieh et al. 1981). The

disturbance of contaminated sediments may be more of a concern near areas of municipal, urban and industrial development, and areas that are downstream (estuary) from such development. Dredging activity that has any federal association is subject to an environmental assessment under the Canadian Environmental Assessment Act and is therefore referred to Fisheries and Oceans Canada, Habitat Management Branch and other federal and provincial agencies for review. Such projects are generally well regulated and monitored, with necessary mitigation measures put in place to alleviate adverse effects on marine habitat. While proponents are held liable for harmful alteration, disruption or destruction of marine habitat, there is no requirement for proponents other than federal proponents or proponents of projects with federal association, to report dredging activity to Fisheries and Oceans Canada.

4.7.8 Freshwater Modulation

Introduction: Dam construction on rivers and streams flowing into the Gulf of St. Lawrence has been influenced by early settlement throughout eastern Canada. Hydroelectric development was just coming on stream during the early part of the 20th century, although dam construction in the forestry industry probably dominated this period, as wood rafting dams were constructed on numerous rivers and streams to transport logs down stream. Throughout the second half of the century, the increase in urban populations and the development of large scale industries such as mining, mineral processing and pulp and paper industries produced a growing need for electricity that was fulfilled by hydroelectric developments. Increasing populations and a growing agricultural industry further increased the demand on water resources through the construction of water supply and flood control dams, as well as dams enhancing the recreational use of water resources (Hurndall et al. 2003).

The exact number of dams on rivers and streams flowing into the Gulf of St. Lawrence is currently unknown as the information resides in a number of separate databases. Quebec alone has recorded more than 1,000 dams. Approximately 50% of those enhance the recreational use of water resources. Another 123 dams support hydroelectric development projects, of which 99 were constructed after 1950. Municipal water supplies and wildlife conservation areas account for 104 and 102 dams respectively (Gouvernement du Québec 2005). Along western Newfoundland and southern Labrador, approximately 45 dams have been identified, with about a dozen supporting hydro development and the remainder enhancing water supplies and wildlife conservation areas (Robert Picco, Municipal Affairs: Engineering and Land Use Planning. "pers. comm." 2006). The glaciated landscape that Quebec and Newfoundland and Labrador provides is favourable for large-scale hydro development. While data was not readily available for New Brunswick, Nova Scotia and Prince Edward Island, the topography of these provinces (with the exception of the western portions of New Brunswick and Nova Scotia) is not necessarily suitable for hydro development. Hydroelectric dams are basically non-existent along eastern New Brunswick, the North Shore of Nova Scotia, and Prince Edward Island. All three provinces rely on thermal processes utilizing fossil fuels for much of their electricity needs (NB Power 2006). Small flood control dams may exist in low lying areas where marshland has been cleared for agricultural use. This was a common practice during the mid 1900s, when approximately 32,000 hectares were drained within the three Maritime provinces. Meanwhile, due to favourable climate conditions for agriculture, irrigation dams are nearly non-existent along the Gulf of St. Lawrence.

Based on international standards (>15 meters in height or >10 meters in height and a reservoir capacity greater than one million cu meters), the Canadian Dam Registry lists 933 large dams throughout Canada. Quebec accounts for approximately one third of large dams in Canada with as many as 100 located on waterways flowing into the Gulf of St. Lawrence. The Daniel – Johnson Dam on Quebec's Manicouagan River is the largest dam of its kind in the world, a multiple-arch concrete structure measuring 214 meters high and more than 162 meters in width. The Registry also includes five large hydro dams along western Newfoundland and Labrador (four on the Hinds Lake Hydro

Project and another on Junction Brook/Grand Lake, operated by Deer Lake Power), one flood control dam in Antigonish, Nova Scotia and a water supply dam in Dalhousie, New Brunswick. Hydro dams throughout Quebec and Newfoundland and Labrador consist mainly of concrete gravity and earth embankment structures. Smaller dam structures vary from concrete, earth embankment, rock-fill to wood (Hurndall et al. 2003).

The majority of large scale dams (hydro and a few water supply and flood control dams) along the Gulf of St. Lawrence are owned and operated by provincial governments, power utility companies, or industry (pulp and paper, and mining companies). For the most part, water supply dams are owned and operated by the municipalities which they support, while the ownership of dams constructed to enhance the recreational use of water resources vary from provincial, industry, municipal to private ownership. The owners of dams are responsible for the environmental and safety standards of their dams.

The construction of dams on rivers and streams flowing into the Gulf of St. Lawrence has significant socio-economic benefits. The damming of water resources for hydroelectric development, water supplies, recreational use and flood control provides direct employment in the construction phrase and also supports the economic well-being and further development of municipalities and industries throughout the area.

Dam construction raises a number of environmental concerns, many of which have an immediate and direct effect on the environment, and others that are manifested over time. The damming of rivers and streams alter fish habitat both above and below the dam, potentially changing the water chemistry (mineral content, temperature, oxygen levels) and impeding the behaviour of fish species (Baxter and Glaude 1980). Dams produce large reservoirs above the dam, altering the shoreline habitat and contributing to the decomposition of organic materials, a chemical process that produce elevated levels of methyl-mercury in fish species. Higher levels of methyl-mercury are more likely to be found in freshwater and marine fish species that prey on other fish species that frequent these reservoirs. Studies have shown that it may take up to 30 years for mercury levels in fish to return to levels that are comparable to levels observed in fish in natural lakes, a process that is believed to decrease over time as decomposition of organic material decreases (Hurndall et al. 2003). Dam construction may impede the migration of diadromous fish species such as trout, Atlantic salmon, and eels that depend on both freshwater and marine resources to complete their life cycle. Dams may also alter the chemistry (nutrient composition, temperature and oxygen levels) of downstream water resources (rivers, streams and estuaries) through inconsistent changes in water flow (daily, seasonal); (Baxter and Glaude 1980). Water flow fluctuation may also contribute to erosion and sedimentation below the dam.

Environmental and Safety Standards: In recent years, more emphasis has been placed on environmental standards, an issue that had less focus during the earlier part of the century when many of the existing dams were constructed. This enhanced environmental awareness is reflected in the interest of Aboriginal and environmental groups, and the general public, and have been included in current policies of the dam building industry, and federal (Table 4-58) and provincial (Table 4-59) legislation. Provincial governments are responsible for licensing of dams and regulating the use of water in their respective provinces. The construction of new dams may require an environmental assessment. Environmental assessments often involve both levels of government, allowing for public input and determining if mitigation measures are necessary before the project is allowed to proceed. At the federal level, Fisheries and Oceans Canada, Habitat Management Division provides provisions (Habitat Protection and Pollution Prevention Provisions) under the Fisheries Act that oversees activities that may have an adverse effect on fish habitat. Fisheries and Oceans Canada will provide a letter of advice to the proponent or owner of a project, stating measures to be taken to avoid the "harmful alteration, disruption or destruction" (HADD) of fish habitat. In the case that an HADD cannot be avoided, Fisheries and Oceans Canada issues an authorization to the proponent under Subsection 35 (2) of the Fisheries Act, stating mitigation measures (i.e. construction of fishways) to be

taken to compensate for loss of fish habitat (i.e. replacement or maintenance of affected habitat). An environmental assessment must be completed in accordance to the Canadian Environmental Assessment Act before Fisheries and Oceans can issue an authorization. The Canadian Electricity Association, under its Environmental and Commitment Program requires its members to track the environmental performance of its projects based on a number of environmental indicators and provide an annual report.

Table 4-58 Federal legislation associated with the development of dams.

Federal Legislation
Navigable Waters Protection Act
Transportation of Dangerous Goods Act
Migratory Birds Convention Act
Indian Act
Canada Water Act
Canada Wildlife Act
International River Improvements Act
International Boundary Waters Treaty (1909)
Fisheries Act
Canadian Environmental Assessment Act
Canadian Environmental Protection Act

Table 4-59 Provincial authorities and legislation for dam safety and water use.

Province	Authority	Legislation
Newfoundland and Labrador	Environment and Conservation	Water Resources Act
Quebec	Environment Natural Resources	Dam Safety Act Mining Act
New Brunswick	Environment and Local Government	Clean Water Act Watercourse Alteration Regulation
Nova Scotia	Environment and Labour	Environment Act and Regulations
Prince Edward Island	Environment, Energy and Forestry	N/A

The Canadian Commission on Large Dams (CANCOLD) was established in 1979, supporting the national safety efforts of its members on the International Commission on Large Dams (ICOLD) Safety Committee. In 1989, the Canadian Dam Safety Association (CDSA) was formed, working jointly with CANCOLD to focus efforts on national dam safety. CDSA and CANCOLD later merged to form the current Canadian Dam Association (CDA). The CDA focuses on producing up to date national Dam Safety Guidelines, capitalizing on the expertise of its membership and others within the industry. A number of provinces including Quebec have adopted dam safety standards within their legislation for water use. Meanwhile, there is no specific federal legislation addressing dam safety standards.

The International Joint Commission administers trans-boundary agreements (Boundary Waters Treaty) between Canada and the United States including activity that affect water levels and flow on both sides of the border. In 1953, the Commission established the International St. Lawrence River Board of Control to implement the Commission's instructions concerning the construction and operation of a hydro power development project in the International Rapids Section of the St. Lawrence River by Ontario Hydro and the Power Authority of New York State. The International Joint Commission has recently adopted environmental factors in its trans-boundary agreements.

Summary: Many of the dams associated with the Gulf of St. Lawrence were constructed more than thirty years ago when environmental standards were less stringent than they are today. Upon the renewal of licenses, regulators have an opportunity to apply changes in environmental standards to the operation of existing dams, although operators (especially in hydro development) may be reluctant to enter into negotiations where there is scepticism of the methodologies used to predict impacts on the environment (Steele and Smokorowski 2000). Meanwhile, it is unclear if provincial legislation governing the licensing of dams and utilization of water resources is consistent among the five provinces bordering the Gulf of St. Lawrence. In terms of no-net-loss of fish and fish habitat applied under the Fisheries Act, it may be more difficult for methodology tested on small streams to be applied to larger water bodies (DFO 2005*c*). Hydroelectric development result in significant changes in seasonal water flow patterns, especially during the biologically important spring discharge. It is suggested that hydroelectric development on numerous water resources entering the Gulf of St. Lawrence has probably already reduced the productivity of this ecosystem, and will continue with further hydroelectric developments (Dunbar 1980). While the nature of changes upstream and downstream from a dam is fundamentally different, more consideration must be given to the ecosystem as a whole, including the river system, estuarine and marine environment, and the species that depend on this ecosystem to complete there life cycle.

5.0 SYNOPSIS

The purpose of this document is to provide a descriptive overview of the human systems including governance structures, human settlement patterns and human activities within and affecting the Gulf of St. Lawrence and its estuary. The research and writing of this document proved to be challenging in several ways. The processes used to collect and store information, and level of detail provided by the various sources were inconsistent with one another, often following jurisdictional boundaries, either on a national, provincial, municipal or other scale. This made it difficult to extract and then combine information specifically for the Gulf of St. Lawrence. Meanwhile, not all sources were eager to release information.

The challenges experienced with bringing together comparable information in such a multi-jurisdictional setting may symbolize the potential challenges that exist with developing and implementing an integrated management process for the Gulf of St. Lawrence Large Oceans Management Area. An integrated management process must reflect the shared interests of federal, provincial and municipal governments, Aboriginal groups, environmental and stewardship groups, academic and research institutions, economic development associations, industry and municipal residents throughout the area. It will also need to achieve a high level of consistency in legislation and management of comparable activities in each of the jurisdiction.

Human systems are continuously changing due to changing social, cultural and economic conditions. Governance structures and human settlement patterns in the Gulf of St. Lawrence have been influenced over time by the availability of resources and by coastal and marine activities. Traditional industries such as marine transportation and commercial fishing have experienced many changes over the past few decades, but still remain important to the economy. Meanwhile, emerging industries including coastal and marine tourism, aquaculture and oil and gas exploration have experienced rapid growth over the same period.

Human activities place pressure on the health and sustainability of this marine ecosystem and have the potential enhance user conflicts over resources and oceans space. The impact and economic importance of individual activities at the local, provincial, regional or national scales may vary and, at least in part, reflects the reason that management and regulation of oceans activities in the Gulf takes place at many jurisdictional levels. Achieving a balance between the need for input into oceans management at all levels and economic and ecosystem sustainability will be particularly challenging in the Gulf of St. Lawrence.

Canada's Oceans Strategy commits to taking an integrated approach to oceans management, providing stakeholders with the opportunity to input on decisions that affect them, supported by good science and traditional ecological knowledge. Sustainable use of ocean resources in the Gulf of St. Lawrence requires an understanding of the structure and function of the Gulf of St. Lawrence ecosystem combined with an understanding of the interaction of the wide range of human systems and activities. This report, in conjunction with other biophysical and socio-economic information, provides a basis to support an integrated management planning process for the Gulf of St. Lawrence and its estuary.

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APPENDICES

APPENDIX 1. Federal legislation related to oceans management in the Gulf of St. Lawrence.

Legislation	Role in Oceans Management
Fisheries Act	Conservation and management of fisheries and fish habitat, licensing, enforcement, international fisheries agreements; Regulation and control of the deposit of deleterious substances into fish bearing waters, and the investigation of related violations.
Oceans Act	Development and implementation of Oceans Management Strategy, consolidate and clarify federal responsibility for oceans management, and define Canadian maritime zones; Establishment of Canada's maritime boundaries
Canada Shipping Act	Marine Navigation, marine search and rescue, pleasure craft safety, ship source pollution prevention and response, lighthouses; Maritime Search and Rescue; Regulation of services for the safe, economical and efficient movement of ships in Canadian Waters
Coastal Fisheries Protection Act	Monitoring, control, and surveillance.
Fishing and Recreational Harbours Act	Small Craft Harbour development and maintenance.
Navigable Waters Protection Act	Protection of public right to safe navigation and approval mechanism for same
Coasting Trade Act	Grant authority to foreign vessels to conduct marine research within Canada's EEZ; Provides for temporary use of foreign ships when no suitable domestic ship is available. Applies to transportation of passengers and cargo and activities of commercial nature.
Foreign Affairs and International Trade Act	Maritime boundary disputes, Law of the Sea.
International Convention for Safety of Life at Sea Act	Maritime Search and Rescue; Maritime Search and rescue operations.
Emergencies Act	Permits temporary measures to ensure public safety and security.
National Defense Act	Maritime Command, National and Maritime Safety /Security.
Department of Justice Act	Conduct investigations and appropriate litigation (including international)
Canada Petroleum Resources Act	Regulates interest in petroleum in relation to frontier lands of Aboriginal interest; Regulates interest in petroleum in relation to frontier (non accord) lands within Canada including coastal and marine areas.
National Research	Establishes the National Research Council which includes marine engineering and marine biological research

Legislation	Role in Oceans Management
Council Act	
Government Organization Act, Atlantic Canada 1987	Regional economic development activity facilitation.
Natural Sciences and Engineering Research Act	Establishes NSERC which provides grants and support for university research.
Canada Newfoundland Atlantic Accord Implementation Act	Governs the development of offshore resources in Newfoundland and Labrador through establishment of the *Canada Newfoundland Offshore Petroleum Board (CNOPB)*
Canada Nova Scotia Offshore Petroleum Resources Accord Implementation Act	Governs the development of offshore resources in Nova Scotia through establishment of the *Canada Nova Scotia Offshore Petroleum Board (CNSOPB)*
Canada Oil and Gas Operations Act	Regulation of exploration and exploitation of oil and gas
National Transportation Act (1987)	Reviews mergers and acquisitions of marine undertakings, and dispute resolution for marine shippers and carriers.
Pilotage Act	Designation and regulation of marine pilotage areas within Canada.
Public Harbours and Port Facilities Act	Management of public harbours and ports
St. Lawrence Seaway Authority Act	Management and regulation of seaway operations.
Canadian Transportation Accident	Establishment and operation of the Transportation Safety Board and the investigation of transportation accidents.

Legislation	Role in Oceans Management
Investigation and Safety Board Act	
National Parks Act	Provides for the establishment of marine parks and marine conservation areas.
Food and Drugs Act	Ensures the safe use of marine species for human consumption
Canadian Environmental Assessment Act (CEAA)	Provides the process and structure to ensure that environmental assessments are carried out for proposed projects. Ensures the integration of environmental assessment into federal planning and decision making.
Canada Wildlife Act	Wildlife conservation, research and interpretation partnerships and the establishment of protected areas for marine wildlife.
Canadian Environmental Protection Act (CEPA)	Establishment of marine environmental quality guidelines, regulation of ocean disposal/dumping, and the control of land based sources of pollution, offshore oil and gas and toxic substances.
Migratory Birds Convention Act, 1994	Protection and conservation of migratory birds

APPENDIX 2. Provincial government departments and legislation related to oceans management in the Gulf of St. Lawrence.

Legislation	Role in Oceans Management
Newfoundland and Labrador	
Department of Environment and Conservation	
Environment Act	Protection and conservation of the environment and water resources.
Environmental Assessment Act	Process and regulations governing the environmental assessment of proposed undertakings including oceans, coastal and marine projects
Waste Material Disposal Act	Regulation and control of the disposal of waste material.
Pesticides Act	Control and regulation of the distribution and application of pesticides
Department of Fisheries and Aquaculture	
Professional Fish Harvesters Act	Establishment of the Professional Fish Harvesters Board and the certification of professional fish harvesters.
Federal Provincial Joint Fisheries and Aquaculture Development Agreements	Assistance to fisheries and aquaculture industries through provision of joint federal – provincial programs to foster the development of fishery and aquaculture activities.
Aquaculture Act and Regulations	Aquaculture development, licensing, inspection and research and development
Department of Government Services and Lands	
Lands Act	Management and control of crown land, incl. foreshore/coastal areas
Department of Natural Resources	
Canada Newfoundland Atlantic Accord Implementation Act	Implementation of a federal provincial agreement on offshore petroleum resources management and development, and the joint management of offshore petroleum developments.
Department of Municipal and Provincial Affairs	
Municipalities Act	Establishment and administration of municipal governments.
Department of Tourism Culture and Recreation	
Historic Resources Act	Preservation of historic resources of cultural, natural, scientific, or aesthetic interest.
Provincial Parks Act	Establishment, management and administration of provincial parks
Wilderness and Ecological Reserves Act	Creation and management of reserves that may contain representative or unique ecosystems, species or natural phenomenon.
Quebec[50]	
Ministère des Affaires Municipales et de la Métropole (MAMM)	
Code Municipal du Québec,	Although each municipality has its own water and sewage system, the MAMM is the authority regarding distribution of drinking water and sewage collection and treatment. Its main role is to verify the respect of norms by municipalities and provide funding
Loi sur l'Aménagement et l'urbanisme,	
Loi sur les Cités et villes,	

[50] **Source : MPO, 2002. La gestion intégrée à la portée de tous — Démarche méthodologique pour les collectivités côtières du Saint-Laurent marin. Annexe 2./ www.bape.gouc.qc.ca dans : Rapport du comité sur la gestion de l'eau au Québec (Mai 2000), Chapitre 2/Seules les municipalités sises le long du Saint-Laurent ont été prises en compte.**

Legislation	Role in Oceans Management
Loi concernant les Droits sur les mutations immobilières,	for infrastructures. Similarly, it is responsible for the management of water bodies in agricultural areas. In addition, it is responsible for the application of land management plans by regional county municipalities, in particular those relative to policies set by the ministry of the environment.
Loi instituant le Fonds spécial de financement des activités locales,	
Loi sur l'Organisation territoriale municipale,	
Loi sur la Société québécoise d'assainissement des eaux,	
Loi sur les Travaux municipaux	
Ministère de l'Agriculture, des Pêcheries et de l'Alimentation (MAPAQ)	
Loi sur les Abus préjudiciables à l'agriculture,	The MAPAQ has the mandate to insure the sustainable development of agriculture, fisheries, aquaculture and food industries. As such, it is the main authority responsible for the management of these activities, as well as conducting applied research in these areas.
Loi sur l'Acquisition des terres agricoles par les non-résidants,	
Loi sur le Bureau d'accréditation des pêcheurs et des aides pêcheurs du Québec,	
Loi sur la Commercialisation des produits marins, Loi sur les Établissements d'hébergement touristique,	
Loi sur le Financement des pêches commerciales,	
Loi sur le Mérite national de la pêche et de l'aquaculture,	
Loi sur la Mise en marché des produits agricoles, alimentaires et de la pêche,	
Loi sur l'Ordre national du Mérite agricole,	
Loi sur les Pêcheries et l'aquaculture commerciale,	
Loi sur les Producteurs agricoles,	
Loi modifiant la Loi sur les Produits agricoles, les produits marins et les aliments,	
Loi sur la Protection du territoire et des activités agricoles,	
Loi sur la Protection des plantes,	
Loi sur les Sociétés agricoles et laitières,	
Loi sur les Terres du domaine de l'état,	
Loi sur les Terres agricoles du domaine de l'état,	
Loi sur la Transformation des produits marins	
Ministère de l'Environnement (MENV)	
Loi sur le Conseil de la conservation de l'environnement (abrogée),	The MENV is the leading authority with respect to the management of water. It is responsible for several provincial regulations relative to drinking water, underground water, agriculture, sewage treatment and the protection of shoreline habitats. It also manages an industrial waste reduction program (Programme de réduction des rejets industriels) caracterised by an integrated water, air and soil polution reduction effort.
Loi sur la Conservation et la mise en valeur de la faune (articles 77 et 78),	
Loi sur la Conservation du patrimoine naturel,	
Loi portant restriction à l'Élevage de porcs,	
Loi sur les Espèces menacées ou vulnérables,	
Loi sur l'Établissement et l'agrandissement de certains lieux d'élimination de déchets,	
Loi instituant le Fonds national de l'eau,	

Legislation	Role in Oceans Management
Loi portant sur l'Interdiction d'établir certains lieux d'élimination de déchets,	
Loi sur les Pesticides,	
Loi visant la Préservation des ressources en eau,	
Loi sur la Protection des arbres,	
Loi sur la Provocation artificielle de la pluie,	
Loi sur la Qualité de l'environnement,	
Loi sur le Régime des eaux,	
Loi sur la Sécurité des barrages,	
Loi sur la Société québécoise de récupération et de recyclage	
Ministère des Ressources naturelles, de la Faune et des Parcs (MRNFP)	
Loi sur le Cadastre,	The MRNFP is responsible for the management of public lands, wildlife, forestry and mining. It is also the main authority regarding hydroelectric development and energic policies.
Loi sur les Clubs de chasse et de pêche,	
Loi sur les Compagnies de flottage,	
Loi sur la Conservation de la faune,	
Loi sur la Conservation et la mise en valeur de la faune,	
Loi sur le Crédit forestier,	
Loi favorisant le Crédit forestier par les institutions privées,	
Loi concernant les Droits sur les Mines,	
Loi sur les Espèces menacées ou vulnérables (espèces fauniques et leur habitat),	
Loi sur l'Exportation d'électricité,	
Loi sur les Forêts,	
Loi sur Hydro-Québec,	
Loi sur les Mines,	
Loi sur les Parcs,	
Loi sur le Parc	
Forillon et ses environs,	
Loi sur le Parc marin Saguenay-Saint-Laurent,	
Loi sur les Pêches,	
Loi sur les Produits et les équipements pétroliers,	
Loi sur le Régime des eaux,	
Loi sur les Systèmes municipaux et les systèmes privés d'électricité,	
Loi sur les Terres du domaine de l'état	
Ministère de la Santé et des Services sociaux (MSSS)	
Loi sur le Conseil de la santé et du bien-être,	The MSSS determines the priorities, objectives and orientations of Québec in terms of health. It is involved in the management of drinking water, the quality of recreational waters and the quality of aquatic organisms destined for human consumption.
Loi sur la Santé publique	
Loi sur les Services de santé et les services sociaux	

Legislation	Role in Oceans Management
Ministère des Transports (MTQ)	
Loi sur la Société des traversiers du Québec *Loi sur les Véhicules hors route*	The MTQ has certain responsibilities in the management of marine transportation, in particular interprovincial transport, ferry services and cargo/passenger boat service on the Lower North Shore. It is the owner of about 20 docks in Québec. Through the Secrétariat à la mise en valeur du Saint-Laurent, it promotes the Saint-Lawrence as communication and commercial axis.
New Brunswick	
Department of Agriculture and Rural Development	
Agriculture Act	Policy and regulations for all agriculture lands, encourages sustainable development and environmental protection.
Department of Economic Development and Tourism	
Economic Development Act	Financial support to encourage the establishment/development of industry or to improve existing industry.
Department of Environment	
Clean Environment Act	Regulates the disposal or introduction of any contaminant or waste that may be harmful to the environment.
Clean Water Act	Ensure that all bodies of water are protected from contaminants, alterations and disturbances of ground within 30 m of banks/shorelines.
Department of Agriculture, Fisheries and Aquaculture	
Aquaculture Act	Sets responsibility for site allocation and tenure at marine aquaculture sites.
Fisheries Development Act	Financial assistance to aid and encourage the establishment or development of fisheries.
Fish Processing Act	Issuance of licenses, determine species for which the license is valid and inspection of processing facilities
Fish Inspection Act	Inspection of processing plants and products.
Department of Health and Community Services	
Health Act	Establishes authority to regulate onsite sewage disposal and to monitor and regulate drinking water and recreational waters.
Department of Environment and Local Government	
Clean Environment Act; *Clean Water Act*	Provides the authority to control and stop contaminant discharge into the environment, and order the cleanup of contaminated sites. Provides administrative procedures for various systems of approvals, permits, registrations and other authorizations which the department issues.
Department of Natural Resources and Energy	
Crown Lands and Forests Act	Provides authority to administer and control crown lands including submerged lands
Parks Act	Designates authority over marine activities within provincial parks
Mining Act	Controls the exploration and development of offshore mineral deposits

Legislation	Role in Oceans Management
Oil and Natural Gas Act	Provides authority to explore for and produce oil and natural gas both onshore and offshore
Pipeline Act	Provides for the granting of permits and licenses to operate pipelines
Quarriable Substances Act	Controls the extraction of quarriable substances on crown lands and on private in shore designated areas.
Nova Scotia	
Department of Fisheries and Aquaculture	
Fisheries and Coastal Resources Act	Programs to protect sustain and improve the fishing industry including the processing and aquaculture sectors. Develop and optimize the processing segments of fishing and aquaculture. Expand recreational and sport fishing. Foster community involvement in management of coastal resources.
Department of Environment	
Environment Act	Protect, enhance and prudent use of environment to ensure ecosystem integrity, sustainable development, and environmental assessment.
Department of Natural Resources	
Beaches Act	Control and management and protection of beaches (e.g. sand and gravel removal)
Beaches and Foreshores Act	Grants or leases for oyster cultivation and for fish traps/weirs
Provincial Parks Act	Designates and manages coastal parks and beaches
Trails Act	Governs trails on land and over watercourses
Wildlife Act	Management of wild species including fish, and defines provincial waters.
Crown Lands Act	Effective use of crown lands including shoreline reclamation and use
Endangered Species Act	Protection, designation, recovery and other relevant aspects of conservation of species at risk, including habitat protection (land, water or air).
Department of Energy	
Petroleum Resources Act	Procedures for granting rights in petroleum resources in NS including the seabed and sub soil of the continental shelf
Energy and Mineral Resources Conservation Act	Regulates the conservation and wasting of energy and mineral resources including the seabed and subsoil of the continental shelf.
Pipeline Act	Construction, operation and management of petroleum pipelines on land and offshore.
Canada Nova Scotia Offshore Petroleum Resources Accord Implementation (NS) Act	Joint management of offshore petroleum resources and conditions attached to exploration.
Department of Housing and Municipal Affairs	
Planning Act	Planning and policy making including watercourses and coastal areas and beaches.
Department of Agriculture and Marketing	
Marshland Reclamation Act	Maintenance and conservation of dyked lands below high tides.
Department of Transportation and Public Works	

Legislation	Role in Oceans Management
Ferries Act	Provides for ferries over harbors, bays, rivers and creeks
Wharves and Public Landings Act	Control of wharves and public landings under provincial jurisdiction
Prince Edward Island	
Department of Fisheries and Environment	
Environmental Protection Act	Protection, enhancement and use of environment to ensure ecosystem integrity, sustainable development, and environmental assessment.
Fish Inspection Act	Regulations to ensure seafood is purchased and marketed under sanitary conditions and sets standards for such facilities.
PEI Fisheries Act	Licensing of all processors and buyers of fish and fish products.
Department of Community Affairs and the Attorney General	
Planning Act	Enables planning, and policy making with respect to watercourses and coastal areas including mapping in coastal areas.

APPENDIX 3. Aboriginal groups in the Gulf of St. Lawrence.

Province	Aboriginal Group[51]	Band	Band Council
Newfoundland and Labrador	Mi'kmaq	Indian Head First Nations	Indian Head First Nations Band Council
		Benoits Cove Indian Band	Benoits Cove Indian Band Council
		Port au Port Indian Band	Port au Port Indian Band Council
		Corner Brook Indian Band	Corner Brook Indian Band Council
		St. Georges Indian Band	St. Georges Indian Band Council
		Flat Bay Indian Band	Flat Bay Indian Band Council
	Metis	Labrador Metis Nation	Labrador Metis Nation
Quebec	Mi'kmaq	Listuguj	Conseil de la nation Listuguj Mi'gmaq
		Gesgapegiag	Conseil de bande des Micmacs de Gesgapegiag
		Gespeg	Conseil de la nation Micmac de Gespeg
	Montagnais (Innu)	Pakuashipi	Conseil des Innus de Pakuashipi
		Unamen Shipu (La Romaine)	Conseil des Montagnais d'Unamen Shipu
		Natashquan	Conseil des Montagnais de Natashquan
		Ekuanishit (Mingan)	Conseil des Innus de Ekuanishit
		Betsiamites	Conseil de bande de Betsiamites
		Essipit	Conseil des Innus d'Essipit
		Uashat mak Mani-Utenam	Conseil Innu Takuaikan Uashat mak Mani-Utenam
	Malecite	Malécite de Viger	Première Nation Malécite de Viger
New Brunswick	Mi'kmaq	Eel River Bar	Eel River Bar First Nation
		Pabineau	Mi'gmaq Nation at Pabineau
		Burnt Church	Council of Burnt Church First Nation
		Metepenagiag (Red Bank)	Metepenagiag Mi'gmaq Nation
		Indian Island	Council of Indian Island First Nation

[51] Indian and Northern Affairs Canada. 2004.

Province	Aboriginal Group[51]	Band	Band Council
		Elsipogtog (Big Cove)	Council of Elsipogtog Nation
		Eel Ground	Council of Eel Ground First Nation
		Buctouche	Council of Buctouche First Nation
Nova Scotia	Mi'kmaq	Pictou Landing	Pictou Landing First Nation
		Paq'tnkek	Paq'tnkek (Afton) First Nation
Prince Edward Island	Mi'kmaq	Abegweit	Abegweit First Nation
		Lennox Island	Lennox Island First Nation

APPENDIX 4. National parks and historic sites of Canada in the Gulf of St. Lawrence.

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Gros Morne National Park and World Heritage Site	Bonne Bay to Cow Head, western Newfoundland	NL	1805 sq km	Coastal, marine, geological, cultural	Camping, kayaking, boat tours, recreational boating, cruise ships, coastal and alpine hiking	Parks Canada
Port aux Choix National Historic Site	Port aux Choix, northern peninsula	NL	N/A	Archaeological (Maritime Archaic Indian, Groswater and Dorset Palaeo Eskimo, recent Indians), geological, coastal, marine, historical (Point Riche lighthouse - 19th century)	Tourist attraction, coastal hiking	Parks Canada
L'Anse aux Meadows National Historic and World Heritage Site	L'Anse aux Meadows, northern peninsula	NL	N/A	Archaeological (Viking settlement - 1000 A.D.), coastal, marine	Tourist attraction, coastal hiking	Parks Canada
Red Bay National Historic Site	Red Bay, southern Labrador	NL	N/A	Archaeological (16th century Basque whaling port), historical, coastal, marine	Tourist attraction, coastal hiking, boat tours	Parks Canada
Cape Breton Highlands National Park	Northern Cape Breton Island	NS	950 sq km	Coastal, marine, geological, cultural (Acadian)	Camping, hiking, boating, kayaking	Parks Canada
Kouchibouguac National Park	Kouchibouguac	NB	238 sq km	Archaeological, coastal, marine (2nd largest tern colony in North America)	Camping, hiking, swimming, boat tours, recreational boating, bird watching, kayaking	Parks Canada

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Boishébert and Beaubears Island Shipbuilding National Historic Sites	Beaubears Island, Miramichi River	NB	2 sq km	Archaeological, historical (remnants of a 19th century ship building center), coastal, marine	Tourist attraction, boating	Parks Canada
Prince Edward Island National Park	Tracadie Bay to the New London Bay	PEI	32 sq km	Coastal (sand dune and beaches), marine	Camping, swimming, kayaking, hiking, boating, fishing	Parks Canada
Mingan Archipelago National Park Reserve	Longue-pointe-de-Mingan to Aguanish	Quebec	150 km	Coastal, marine (offshore islands)	Camping, kayaking, boat tours	Parks Canada
Forillon National Park	Eastern Gaspé Peninsula	Quebec	244 sq km	Coastal, marine	Hiking, camping, boat tours	Parks Canada
Grosse-Île and the Irish Memorial National Historic Site	Îles-aux-Grue (St. Lawrence estuary)	Quebec	N/A	Coastal, marine, historical (19 century quarantine station for immigrants entering Canada)	Tourist attraction, boat tours	Parks Canada
Pointe-au-Père Lighthouse National Historic Site	Pointe-au-Père	Quebec	N/A	Historical, coastal, marine	Tourist attraction	Parks Canada
Battle of the Restigouche National Historic Site	Baie-des-Chaleurs	Quebec	N/A	Historical (last naval battle between French and English – 1760), coastal, marine	Tourist attraction	Parks Canada

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Saguenay-Saint-Lawrence Marine Park	St. Lawrence estuary/ Saguenay Fjord	Quebec	1,138 sq km	Marine		Parks Canada/ Quebec government

APPENDIX 5. Provincial (Quebec National) parks and historic sites in the Gulf of St. Lawrence.

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Pinware River Provincial Park	Pinware, southern Labrador	NL	68 ha	Coastal, marine (located at the mouth of a scheduled salmon river (Pinware River)	Camping, angling;	NL Department of Tourism, Culture and Recreation
Pistolet Bay Provincial Park	Pistolet Bay, northern peninsula	NL	897 ha	Coastal, marine	Camping, recreational boating	NL Department of Tourism, Culture and Recreation
The Arches Provincial Park	approximately 10 km north of Parsons Pond, northern	NL	13 ha	Coastal (sea caves), marine	Tourist attraction, day use, coastal hiking	NL Department of Tourism, Culture and Recreation
Blow Me Down Provincial Park	Lark Harbour, Bay of Islands	NL	226 ha	Coastal, marine	Camping, coastal hiking, recreational boating, kayaking	NL Department of Tourism, Culture and Recreation
Codroy Valley Provincial Park	Codroy Valley, southwestern Newfoundland	NL	24 ha	Coastal, marine	Coastal hiking, day use	NL Department of Tourism, Culture and Recreation
J. T. Cheeseman Provincial Park	Cape Ray, southwestern Newfoundland	NL	206 ha	Coastal (Colony of endangered Piping Plover), marine	Camping, swimming, coastal hiking, bird watching	NL Department of Tourism, Culture and Recreation
Point Amour Lighthouse Provincial Historic Site	Point Amour, southern Labrador	NL	N/A	Historical (19th century lighthouse - tallest lighthouse in Atlantic Canada, record of shipwrecks), coastal, marine	Tourist attraction	NL Department of Tourism, Culture and Recreation
Amherst Shore Provincial Park	Coldspring Head	NS	N/A	Coastal, marine	Camping, swimming	NS Tourism and Culture

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Arisaig Provincial Park	Malignant Cove	NS	24.7 ha	Coastal, marine, geological (fossils)	Coastal hiking, day use	NS Tourism and Culture
Bayfield Beach Provincial Park	Bayfield	NS	N/A	Coastal, marine	Swimming, day use	NS Tourism and Culture
Caribou-Monroe Islands Provincial Park	Caribou Island	NS	31.6 ha	Coastal, marine	Swimming, day use, camping	NS Tourism and Culture
Fox Harbour Provincial Park	Fox Harbour	NS	N/A	Coastal, marine	Swimming, day use	NS Tourism and Culture
Gulf Shore Provincial Park	Pugwash	NS	9.3 ha	Coastal, marine	Swimming, day use	NS Tourism and Culture
Heather Beach Provincial Park	Lewis Head	NS	7.2 ha	Coastal, marine	Swimming, day use	NS Tourism and Culture
Melmerby Beach Provincial Park	Merigomish Harbour	NS	101.2 ha	Coastal, marine	Swimming, day use	NS Tourism and Culture
Northport Beach Provincial Park	Northport	NS	10.5 ha	Coastal, marine	Swimming, day use	NS Tourism and Culture

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Pomquet Beach Provincial Park	Pomquet	NS	N/A	Coastal, marine	Swimming, day use	NS Tourism and Culture
Port Hood Station Provincial Park	Port Hood	NS	3 km	Coastal (sand dune), marine	Swimming, day use	NS Tourism and Culture
Powells Point Provincial Park	Chance Harbour	NS	27.1 ha	Coastal, marine	Swimming, day use	NS Tourism and Culture
Rushtons Beach Provincial Park	Tatamagouche	NS	25.5 ha	Coastal (sand bar), marine	Swimming, day use, bird watching	NS Tourism and Culture
Tidnish Dock Provincial Park	Tidnish	NS	10.5 ha	Historic (eastern terminus of the Chignecto Marine Transport Railway), coastal, marine	Tourist attraction, swimming, day use	NS Tourism and Culture
Waterside Provincial Park	Seafoam	NS	80.9 ha	Coastal, marine	Swimming, day use, bird watching	NS Tourism and Culture
Parlee Beach Provincial Park	Pointe-du-Chene	NB	65.9 ha	Coastal, marine	Camping, swimming	NB Tourism and Parks
Murray Beach Provincial Park	Murray Corner	NB	26.8 ha	Coastal, marine	Camping, swimming	NB Tourism and Parks

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Val Comeau Provincial Park	Val-Comeau	NB	22.1 ha	Coastal, marine	Camping, swimming, boat tours (deep sea fishing excursions)	NB Tourism and Parks
Acadian Historic Site	Caraquet	NB	N/A	interpretation centre; museum	tourist attraction	NB Tourism and Parks
Brudenell River Provincial Park	Roseneath	PEI	563.3 ha	Coastal (two golf courses), marine (marina)	Golf, swimming, hiking, recreational boating, boat tours, camping, kayaking, day	PEI Department of Tourism
Cabot Beach Provincial Park	Darnley Basin	PEI	138.4 ha	Coastal, marine	Camping, swimming, kayaking, guided nature tours, boat tours, deep sea fishing excursions	PEI Department of Tourism
Cedar Dunes Provincial Park	West Point	PEI	57.1 ha	Coastal, marine, historical (lighthouse)	Camping, swimming, recreational boating, tourist attraction, guided nature tours	PEI Department of Tourism
Green Park Provincial Park	north of Port Hill	PEI	95.1 ha	Coastal, marine, historical (ship building museum)	Camping, swimming, tourist attraction	PEI Department of Tourism
Jacques Cartier Provincial Park	Kildare area	PEI	11.3 ha	Coastal, marine, historical (site of Jacques Cartier's landing)	Camping, swimming, tourist attraction, guided nature tours	PEI Department of Tourism
Linkletter Provincial Park	Linkletter	PEI	29.5 ha	Coastal, marine	Camping, swimming	PEI Department of Tourism

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Lord Selkirk Provincial Park	Eldon	PEI	60.3 ha	Coastal (golf course), marine, historical (town of Eldon)	Camping, golf, coastal hiking;, tourist attraction	PEI Department of Tourism
Mill River Provincial Park	St. Anthony	PEI	183.7 ha	Coastal (golf course), marine	Swimming, recreational boating, golfing, camping	PEI Department of Tourism
Northumberland Provincial Park	Wood Islands East	PEI	30.8 ha	Coastal, marine (marina)	Camping, recreational boating	PEI Department of Tourism
Panmure Island Provincial Park	Pamure Island	PEI	35.2 ha	Coastal (sand dunes), marine, historical (Panmure Island Lighthouse)	Camping, swimming, tourist attraction	PEI Department of Tourism
Red Point Provincial Park	Red Point	PEI	6.5 ha	Coastal, marine (borders ferry terminal to Magdalen Islands)	Camping, swimming, boating	PEI Department of Tourism
Argyle Shore Provincial Park	Argyle Shore	PEI	19.4 ha	Coastal, marine	Swimming, day use	PEI Department of Tourism
Basin Head Provincial Park	east of Souris	PEI	N/A	Coastal, marine	Swimming, day use	PEI Department of Tourism
Belmont Provincial Park	Winchester Cape, Maie Malpeque Bay	PEI	11.3 ha	Coastal, marine	Swimming, day use	PEI Department of Tourism

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Bloomfield Provincial Park	St. Anthony	PEI	5.3 ha	Coastal (golf course), marine	Day use, golf, angling	PEI Department of Tourism
Bonshaw Provincial Park	Bonshaw	PEI	2.4 ha	Coastal, marine	Day use, angling	PEI Department of Tourism
Buffaloland Provincial Park	Milltown Cross	PEI	62.3 ha	Day use, buffalo reserve	Day use, tourist attraction	PEI Department of Tourism
Chelton Beach Provincial Park	Chelton	PEI	7.3 ha	Coastal, marine	Swimming, day use	PEI Department of Tourism
Kings Castle Provincial Park	Gladstone	PEI	N/A	inland	Swimming, day use, tourist attraction	PEI Department of Tourism
Pinette Park Provincial Park	Pinette	PEI	3.2 ha	inland	Swimming, day use, angling	PEI Department of Tourism
Poole's Corner Provincial Park	Pooles Corner	PEI		???	Day use	PEI Department of Tourism
Souris Beach Provincial Park	Souris	PEI	15 ha	Coastal, marine (marina)	Day use, swimming, boating	PEI Department of Tourism

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Union Corner Provincial Park	Union Corner	PEI	3.2 ha	Coastal, marine	Day use, swimming	PEI Department of Tourism
Wood Islands Provincial Parks	Wood Island	PEI	12.1 ha	Coastal, marine (marina)	Day use, swimming, recreational boating	PEI Department of Tourism
Saguenay National Park	Borders the Saguenay River	Quebec	283.6 sq km	Coastal, marine		Développement durable, Environnement et Parcs Quebec
Anticosti National Park	Anticosti Island	Quebec	572 sq km	Coastal, marine		Développement durable, Environnement et Parcs Quebec
Île-Bonaventure and Rocher-Percé National Park	Gaspé Peninsula	Quebec	5.8 sq km	Coastal, marine		Développement durable, Environnement et Parcs Quebec
Miguasha National Park and World Heritage Site	Baie-des-Chaleurs	Quebec	87.3 sq km	Coastal, marine		Développement durable, Environnement et Parcs Quebec

APPENDIX 6. Conservation and protected areas in the Gulf of St. Lawrence.

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Burnt Cape Ecological Reserve	Raleigh	NL	864 ha	Coastal (limestone barrens, more than 300 species of plants including 34 species of rare plants, fossils), marine (sub-Arctic-alpine like climate)	coastal hiking, research, whale and iceberg viewing	NL Department of Tourism, Culture and Recreation
Watts Point Ecological Reserve	approximately 3 km north of Eddies Cove	NL	3,090 ha	Coastal (approximately7.5 km of coastline, rare plants), marine (sub-Arctic-alpine like climate)	coastal hiking; research	NL Department of Tourism, Culture and Recreation
Table Point Ecological Reserve	approximately 3 km north of Bellburns	NL	116 ha	Coastal (1 km of coastline, significant fossil site), marine (sub-Arctic-alpine like climate)	research	NL Department of Tourism, Culture and Recreation
Jim Campbells Barren Provincial Wildness Area	Farm Brook Area	NS	1750 ha	Coastal (old growth forest; mosaic of boreal wetlands, overlaps three watershed areas)	restricted recreational use (hunting, sport fishing, hiking, canoeing, kayaking); research and education	NS Environment and Labour
Margaree River Provincial Wilderness Area	Northeast Margaree River Area	NS	6850 ha	Coastal (protected watershed area; salmon and trout spawning area, recreational fishing)	restricted recreational use (hunting, sport fishing, hiking, canoeing, kayaking); research and education	NS Environment and Labour
Margaree - Lake Ainslie Heriage River	Margaree - Lake Ainslie Watershed	NS	120 km	Coastal (drains 120,000 hectare watershed; salmon and trout spawning area; recreational fishing, portions of river privately owned)	recreational (sport fishing; canoeing, kayaking)	NS Environment and Labour

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Pollets Cove-Aspy Fault Provincial Wilderness Area	Cape St. Lawrence Area	NS	27,230 ha	Coastal (unique highland and coastal features - faults and canyons), geological	restricted recreational use (hunting, sport fishing, hiking, canoeing, kayaking); research and education	NS Environment and Labour
Eigg Mountain-James River Wilderness Area	Pictou-Antigonish Highlands	NS	4,150 ha	Upland area of rolling hills, undisturbed forest, headwaters of three rivers	restricted recreational use (hunting, sport fishing, hiking, canoeing, kayaking); research and education	NS Environment and Labour
Sea Wolf Island National Wildlife Area	Margaree Island	NS	54 ha	Coastal, marine		Environment Canada
Wallace Bay National Wildlife Area	Wallace Bay	NS	58.5 ha	Coastal, marine		Environment Canada
Bay du Vin Island Provincial Protected Natural Area	Eastern Lowlands Ecoregion	NB	214 ha	Coastal (salt marshes, sand dunes, rare flora, major nesting site for great blue heron and osprey), marine	Restricted to scientific research and monintoring	NB Natural Resources
Tabusintac Provincial Protected Natural Area	Eastern Lowlands Ecoregion	NB	108 ha	Coastal (salt marshes, major nesting site for great blue heron and osprey), marine	Restricted to scientific research and monintoring	NB Natural Resources

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Black River Provincial Protected Natural Area	Eastern Lowlands Ecoregion	NB	4,000 ha	Adjacent to Kouchibouguac National Park, coastal (forest, bogs and barrens, area previously affected by human activity)	Restricted to scientific research and monintoring	NB Natural Resources
Jacquet River Gorge Provincial Protected Natural Area	Northern Uplands Ecoregion	NB	26,000 ha	Coastal (boreal forests, lime-rich soils, cliffs and gorges, area previously affected by human activity)	Restricted to scientific research and monintoring	NB Natural Resources
La Dune de Bouctouche	Bouctouche	NB	12 km	Coastal (sand bar extending across Bouctouche Bay), marine	Restricted flow of visitors to the area	Irving Eco-Centre
Portage Island National Wildlife Area	Miramichi Bay	NB	439 ha	Coastal (series of coastal barrier beaches, salt marshes, sand dunes, migrating waterfowl, shorebirds), marine	Restricted waterfowl hunting, wildlife observation, hiking	Environment Canada
Cape Jourimain National Wildlife Area	Cape Jourimain; near Bayfield	NB	589 ha			Environment Canada
Black Pond Migratory Bird Sanctuary	Northeast coast	PEI	130 ha	Coastal, marine		Environment Canada

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Manicouagan (Proposed) MPA	Manicouagan Peninsula, west of Baie Comeau	Quebec	700 sq km	Coastal, marine	Marine transportation, industrial, coastal development, marine aquaculture	Department of Fisheries and Oceans
Saint-Lawrence estuary (Proposed) MPA	St. Lawrence estuary (Baie-St-Paul and Betsiamites and Saint-Rock-des-Aulnaies and Métis-sur-Mer)	Quebec	6,000 sq km	Coastal, marine (beluga whale, harbor seal population, blue whale feeding area)	Marine transportation, industrial, coastal development, marine aquaculture	Department of Fisheries and Oceans
Cap Tourmente National Wildlife Area	north shore of the Saint-Lawrence estuary, near Sainte-Anne-de-Beaupré.	Quebec	2399 ha	Coastal (feeding habitat for migrating snow geese), international status (RAMSAR Convention list)	A controlled migratory bird hunt is permitted.	Environment Canada
Baie de L'Isle-Verte National Wildlife Area	south shore of the Saint-Lawrence estuary, 30 km east of Rivière-du-Loup.	Quebec	406 ha	Coastal (spartina marshes, habitat for the American Black Duck), international status (RAMSAR Convention list)	A controlled migratory bird hunt is permitted.	Environment Canada
Îles de l'Estuaire National Wildlife Area	several islands in the Saint-Lawrence estuary between Kamouraska and Bic.	Quebec	407 ha	Coastal (breeding grounds for species of seabirds that nest in colonies)	No hunting permitted.	Environment Canada
Pointe-au-Père National Wildlife Area	south shore of the Saint-Lawrence estuary, 5 km east of Rimouski	Quebec	22.6 ha	Coastal (wetland habitats frequented by shorebirds and other migratory species)	No hunting permitted.	Environment Canada

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Pointe de l'Est National Wildlife Area	Îles-de-la-Madeleine, eastern end of Grosse-Île.	Quebec	748 ha	Coastal (migratory bird staging areas, as well as breeding areas for endangered species - Piping Plover)	Controlled hunting of migratory game birds permitted.	Environment Canada
Montmagny Migratory Bird Sanctuary	south shore of estuary, facing Montmagny	Quebec	80 ha	Coastal (migration staging area for the Greater Snow Goose, ducks and Semipalmated Sandpiper)	No public activity	Environment Canada
Cap St-Ignace Migratory Bird Sanctuary	south shore of estuary, near Cap-St-Ignace	Quebec	133 ha	Coastal (migration area for the Greater Snow Goose and numerous ducks)	No public activity	Environment Canada
L'Islet Migratory Bird Sanctuary	south shore of estuary, near l'Islet	Quebec	64 ha	Coastal (migration staging site for the Greater Snow Goose and many ducks)	Restricted public activity.	Environment Canada
Trois-Saumons Migratory Bird Sanctuary	south shore of estuary, near St-Jean-Port-Joli	Quebec	222 ha	Coastal (migratory staging area for the Greater Snow Goose, the Canada Goose and many ducks)	No public activity.	Environment Canada
L'Isle-Verte Migratory Bird Sanctuary	south shore of estuary, near l'Isle-Verte	Quebec	303 ha	Coastal (migration staging site for the Greater Snow Goose, ducks and the Canada Goose)	Restricted public activity.	Environment Canada

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Ile aux Basques Migratory Bird Sanctuary	island in the estuary, opposite Trois-Pistoles	Quebec	933 ha	Coastal (Breeding area for the Common Eider, and gulls and Double-crested Cormorants colonies)	Restricted public activity.	Environment Canada
Saint Omer Migratory Bird Sanctuary	Baie des Chaleurs, near St-Omer	Quebec	66 ha	Coastal (Important breeding area for gulls and terns)	Restricted public activity.	Environment Canada
Ile Bonaventure et du Rocher Percé Migratory Bird Sanctuary	south shore of gulf, near Percé (Gaspésie)	Quebec	1,360 ha	Coastal, marine (nesting ground for seabirds, in particular the Northern Gannet)	Restricted public activity.	Environment Canada
Rocher-aux-Oiseaux Migratory Bird Sanctuary	in the gulf, east of Île Brion (Îles-de-la-Madeleine)	Quebec	625 ha	Coastal, marine (breeding area for Northern Gannets and other seabirds)	No public activity.	Environment Canada
Ile du Corosol Migratory Bird Sanctuary	north shore of gulf, island facing Sept-Iles	Quebec	413 ha	Coastal, marine (breeding area for seabirds and the Common Eider)	Restricted public activity.	Environment Canada
Betchouane Migratory Bird Sanctuary	north shore of gulf, near Havre-St-Pierre	Quebec	462 ha	Coastal, marine (nesting site for the Common Eider and numerous seabirds)	No public activity.	Environment Canada

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Watshishou Migratory Bird Sanctuary	north shore of gulf, west of Natashquan	Quebec	11,320 ha	Coastal, marine (breeding area for terns, Common Eiders and other seabirds)	Restricted public activity.	Environment Canada
Ile à la Brume Migratory Bird Sanctuary	north shore of gulf, near La Romaine	Quebec	4,320 ha	Coastal, marine (breeding area for the Common Eider and seabirds)	No public activity.	Environment Canada
Baie des Loups Migratory Bird Sanctuary	north shore of gulf, east of La Romaine	Quebec	3,550 ha	Coastal, marine (nesting site for the Common Eider and numerous seabirds)	No public activity.	Environment Canada
Iles Sainte-Marie Migratory Bird Sanctuary	north shore of gulf, near Harrington Harbour	Quebec	4,100 ha	Coastal (breeding area for the Common Eider and numerous seabirds)	Restricted public activity.	Environment Canada
Gros Mecatina Migratory Bird Sanctuary	north shore of gulf, near La Tabatière	Quebec	2,310 ha	Coastal, marine (seabird breeding area)	No public activity.	Environment Canada
Saint Augustin Migratory Bird Sanctuary	north shore of gulf, near St Augustin	Quebec	5,570 ha	Coastal, marine (seabird breeding area)	Restricted public activity.	Environment Canada

Name	Location	Province	Area	Significant Features	Human Activity	Administrative Agency
Baie de Brador Migratory Bird Sanctuary	north shore of gulf, near Blanc Sablon	Quebec	538 ha	Coastal, marine (breeding area for seabirds)	Restricted public activity.	Environment Canada
Île-Brion Ecological Reserve	located 16 km from Grosse-Île, Îles-de-la-Madeleine	Quebec	650 ha	Coastal, marine (representative of the Gulf of Saint-Lawrence ecological region)		Développement durable, Environnement et Parcs Quebec
Heath Point Ecological Reserve	eastern end of Anticosti Island	Quebec	1,869 ha	Coastal (coastal bog growing on calcareous marine deposits)		Développement durable, Environnement et Parcs Quebec
Grand-Lac-Salé Ecological Reserve	Anticosti Island	Quebec	2,339 ha	Coastal, marine (largest lagoon and salt march in the Anticosti-Minganie region)		Développement durable, Environnement et Parcs Quebec
Manche-Saint-Pierre Ecological Reserve	85 km east of Saint-Anne-des-Mont	Quebec	573 ha	Coastal, marine		Développement durable, Environnement et Parcs Quebec
Mont-Saint-Pierre Ecological Reserve	Near the municipality of Mont-Saint-Pierre	Quebec	643 ha	Coastal, marine, geological		Développement durable, Environnement et Parcs Quebec